US005546678A

# United States Patent [19]

**Dhaemers**

[11] **Patent Number: 5,546,678**

[45] **Date of Patent: Aug. 20, 1996**

[54] **ARMOIRE ADAPTABLE TO A SAUNA, DRUM DRYER, AND TUBULAR LIGHTED CLOTHING DRYER WITH HUMIDITY DAMPER CONTROL OF EXHAUST GASES**

[76] Inventor: **Gregory L. Dhaemers**, 829 N. 27th Ave. W., Duluth, Minn. 55806

[21] Appl. No.: **350,224**

[22] Filed: **Dec. 5, 1994**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 72,151, Jun. 4, 1993, Pat. No. 5,369,892.

[51] **Int. Cl.**[6] ..... **F26B 19/00**

[52] **U.S. Cl.** ..... **34/275**; 34/60; 34/224; 34/74; 4/524

[58] **Field of Search** ..... 34/275, 224, 60, 34/74; 4/525, 524, 605

[56] **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 1,755,013 | 4/1930 | McCormick | 34/163 |
| 2,221,351 | 11/1940 | Kempf . | |
| 2,232,022 | 2/1941 | Drake | 34/76 |
| 2,743,533 | 5/1956 | Smith | 34/75 |
| 3,256,616 | 6/1966 | McGoldrick | 34/210 |
| 3,362,081 | 1/1968 | Bogenberger . | |
| 3,513,564 | 4/1970 | Gramprie | 34/104 |
| 3,626,602 | 12/1971 | Glowacki | 34/72 |
| 3,670,425 | 6/1972 | Benjamin et al. | 34/72 |
| 3,739,487 | 6/1973 | Clark | 34/77 |
| 3,739,496 | 6/1973 | Buckley et al. | 312/271 |
| 3,805,561 | 4/1974 | Bullock | 68/12.12 |
| 3,837,088 | 9/1974 | Lenz | 34/29 |
| 3,858,331 | 1/1975 | Lord | 34/75 |
| 3,877,152 | 4/1975 | Gorman | 34/43 |
| 3,897,638 | 8/1975 | Lenz | 34/13 |
| 4,145,602 | 3/1979 | Lee | 219/370 |
| 4,180,919 | 1/1980 | Baltes | 34/86 |
| 4,471,537 | 9/1984 | Meda | 34/77 |
| 4,625,432 | 12/1986 | Baltes | 34/202 |
| 4,677,764 | 7/1987 | Cerny | 34/202 |
| 4,682,424 | 7/1987 | Irving | 34/202 |
| 4,846,145 | 7/1989 | Inouci | 4/524 |
| 4,869,872 | 9/1989 | Baltes | 34/77 |
| 5,127,169 | 7/1992 | Ellingson | 34/601 |
| 5,152,077 | 10/1992 | Liang | 34/219 |
| 5,369,982 | 12/1994 | Dhaemers | 34/275 |
| 5,416,931 | 5/1995 | Wolfenden et al. | 4/524 |

FOREIGN PATENT DOCUMENTS

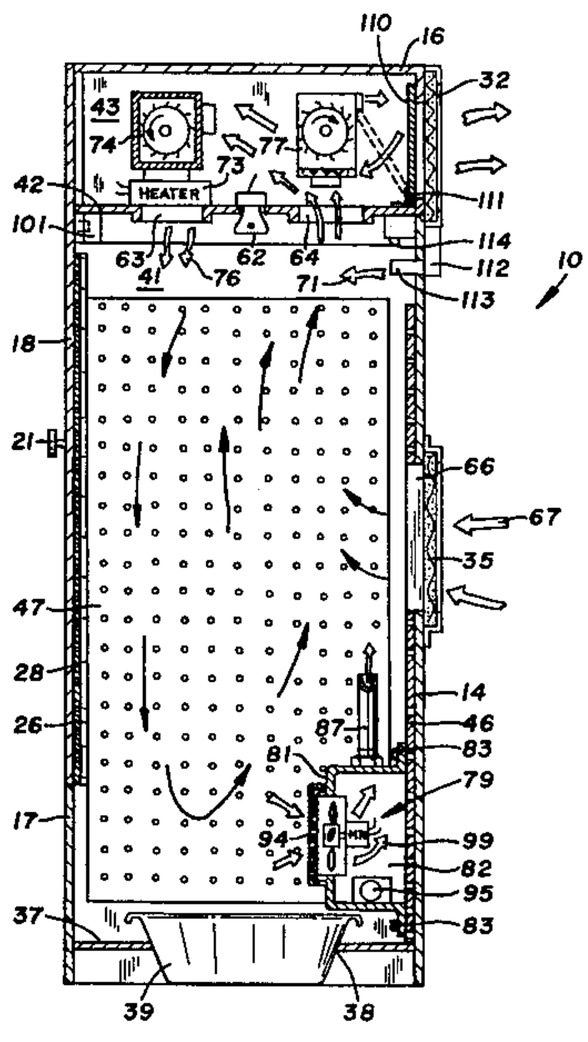
| | | |
|---|---|---|
| 473567 | 8/1991 | European Pat. Off. . |
| 1562056 | 4/1969 | France . |
| 1816272 | 7/1970 | Germany . |

*Primary Examiner*—John M. Sollecito
*Assistant Examiner*—Steve Gravini
*Attorney, Agent, or Firm*—Burd, Bartz & Gutenkauf

[57] **ABSTRACT**

A dryer has an internal drying chamber for accommodating articles that are subjected to heated circulating air to remove moisture from the articles. An air mixing chamber contains a first fan for moving air through a heater into the drying chamber. A second fan draws air out of the drying and mixing chambers and discharges air back into the mixing chamber through a filter into the external environment. The heated air in the drying chamber is mixed with fresh air and recirculated through the drying chamber to minimize heat losses and increase drying effectiveness. Ultraviolet lamps within the drying chamber destroy contaminants in the air and articles within the chamber. A boot dryer, located in the drying chamber, has fans that move air through tubes used to support boots, shoes, skates and socks. Ultraviolet light in the boot chamber destroys contaminants in the air in the boot chamber. One modification of the dryer has a bench to permit the dryer to be used as a dry sauna. A further modification of the dryer has a rotatable tumbler for accommodating articles to be dried.

**20 Claims, 12 Drawing Sheets**



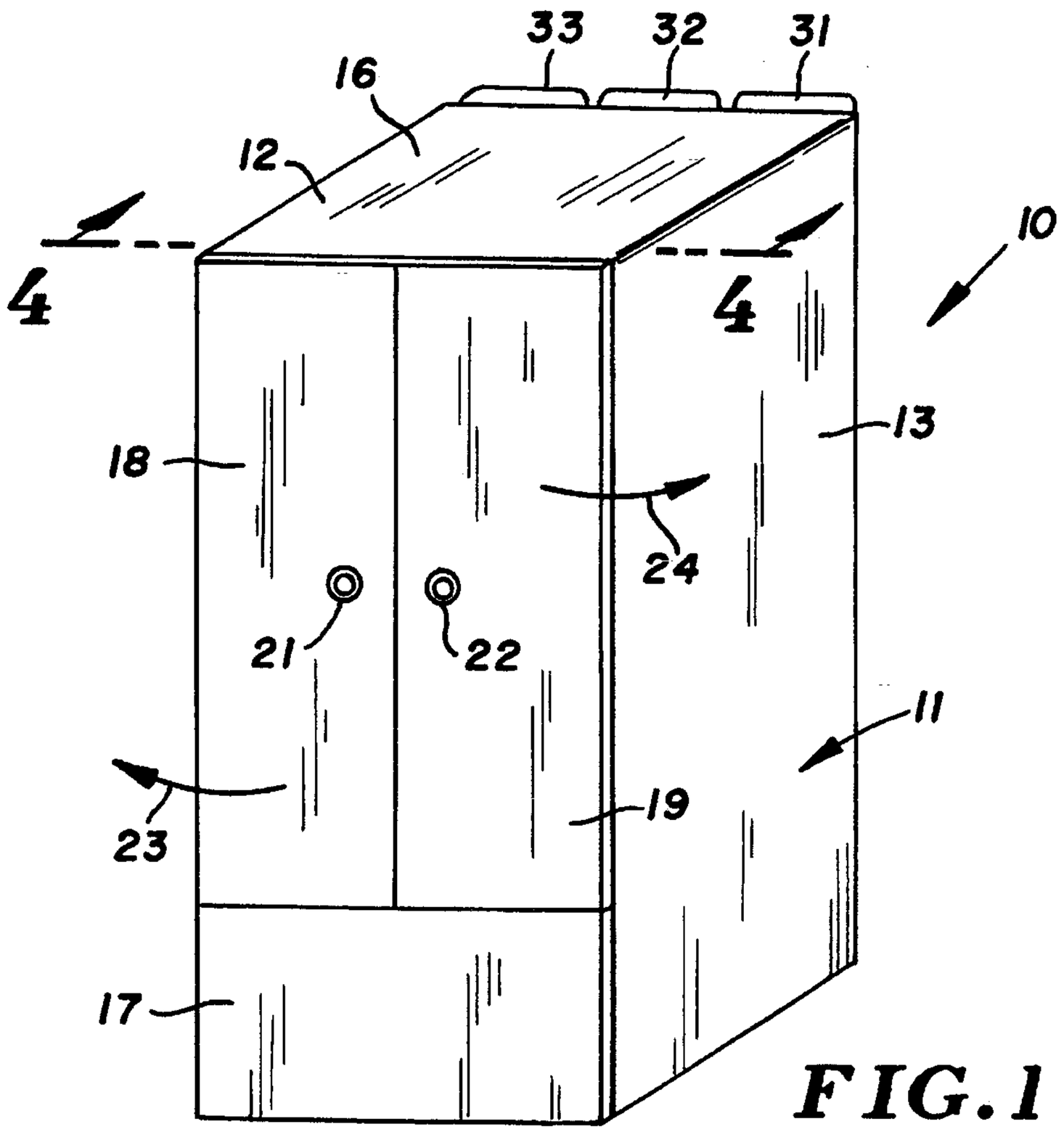



FIG.1

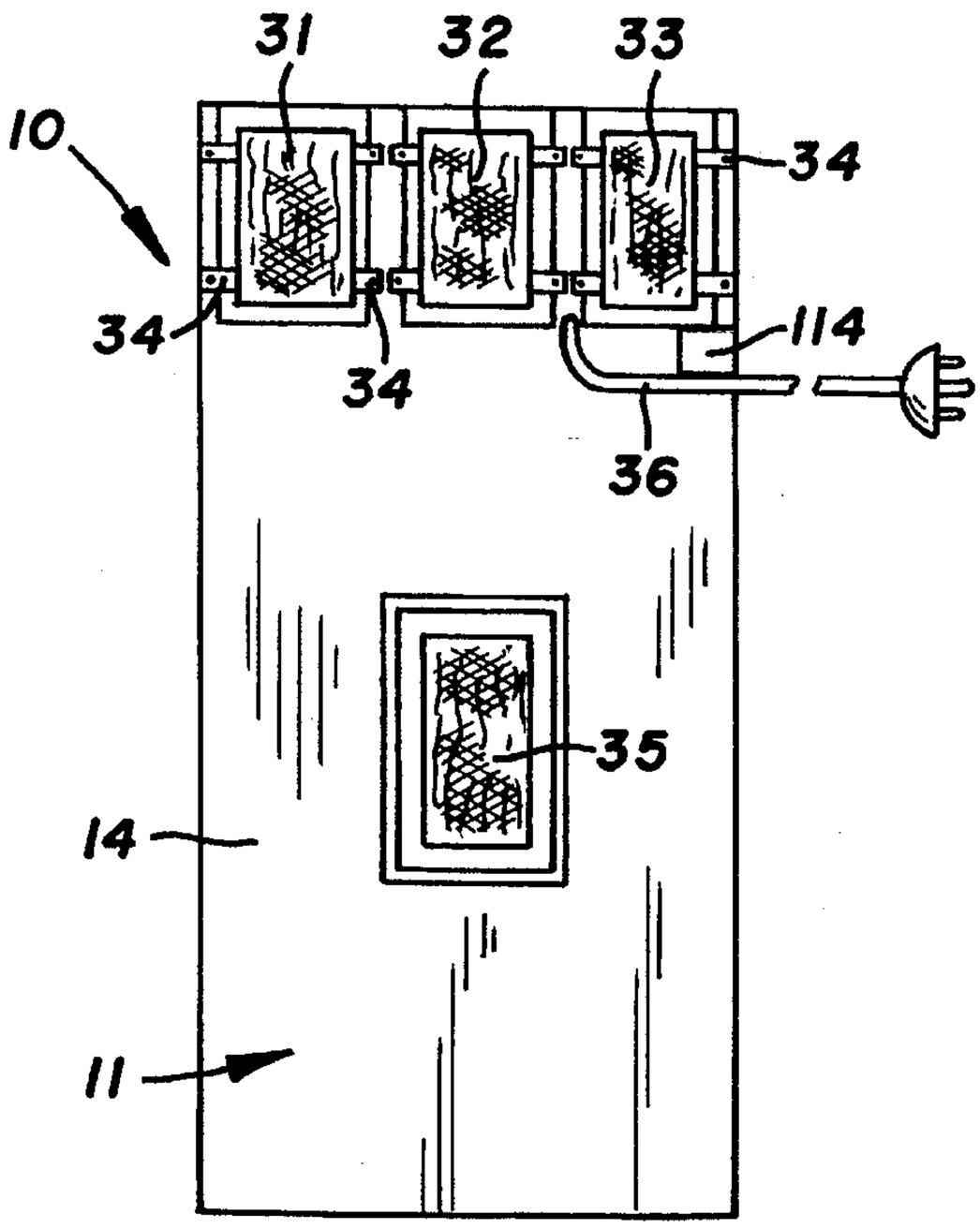



FIG.2

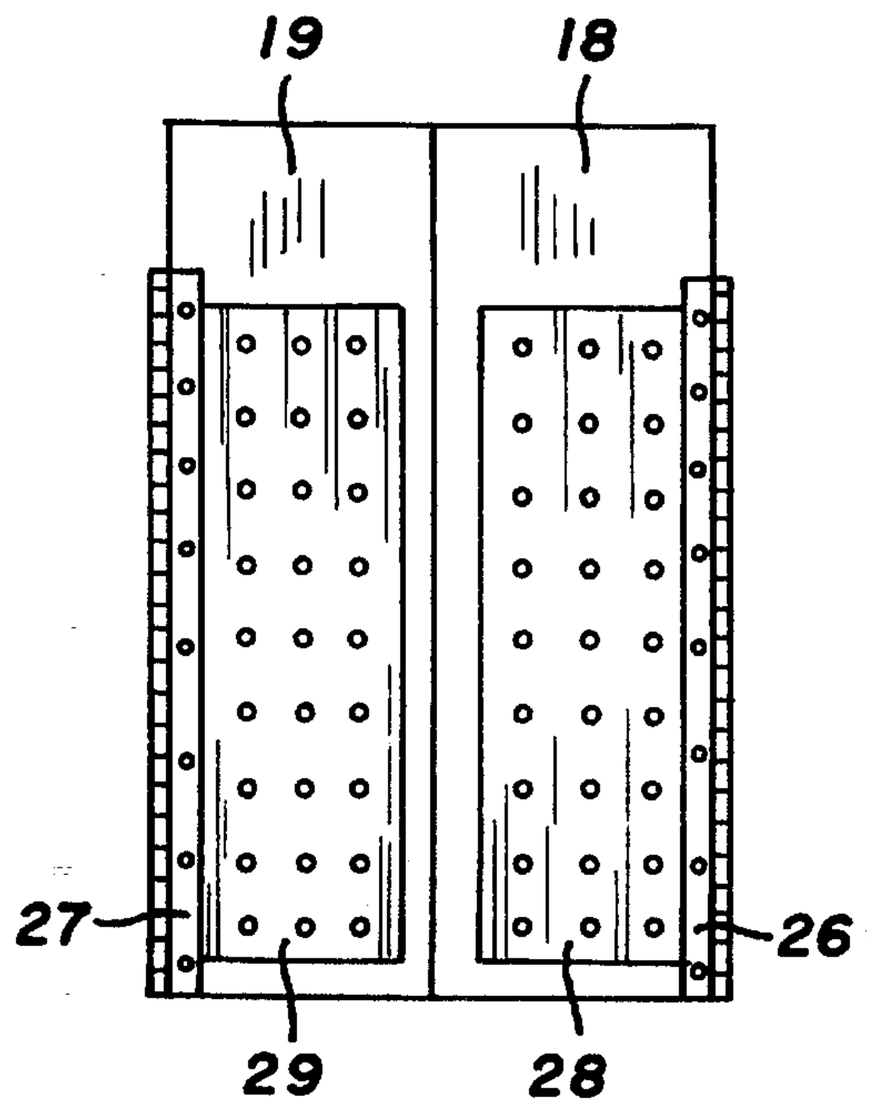



FIG.3

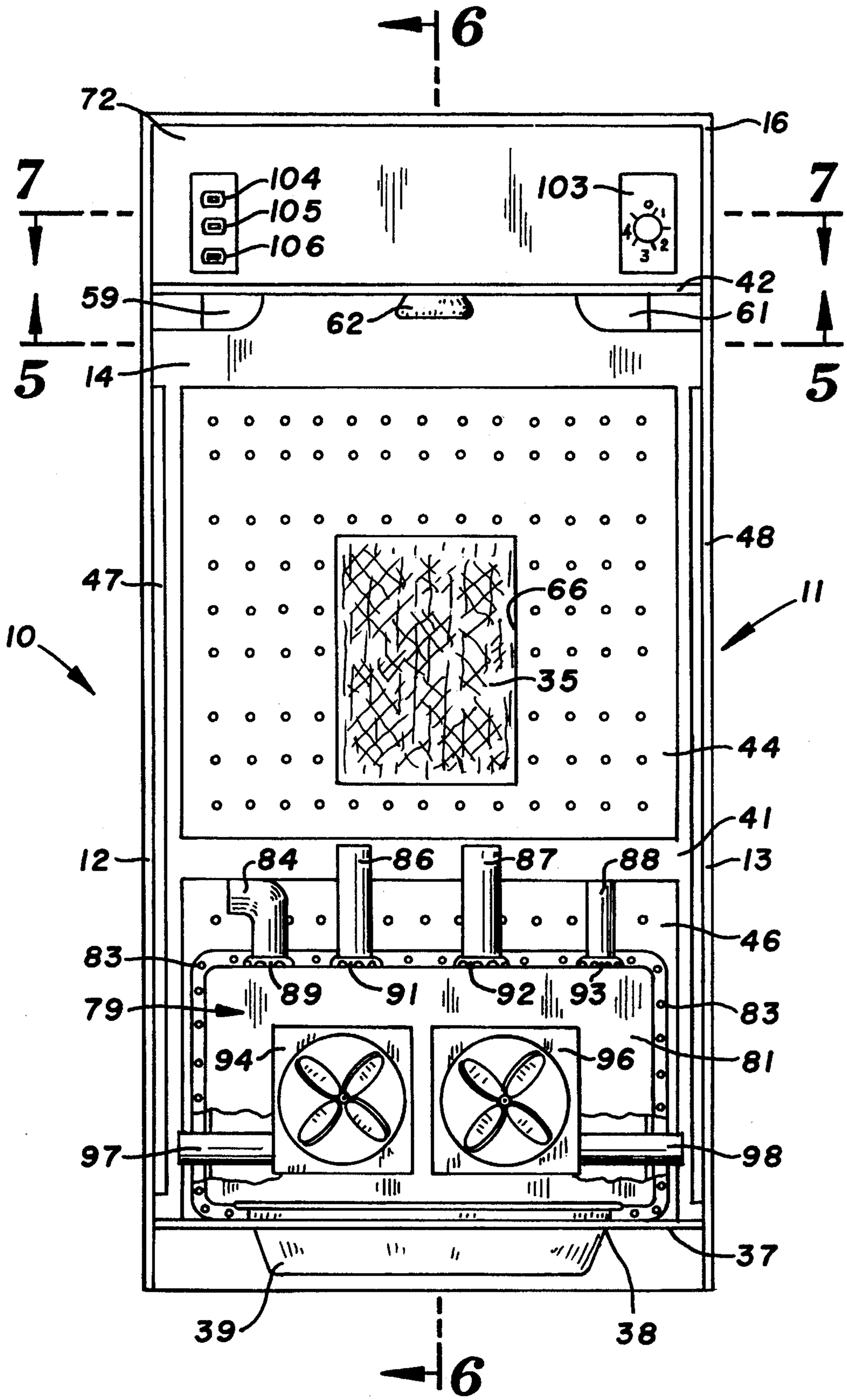

6
72
16
7
104
105
106
103
7
59
42
62
61
5
14
5
48
47
66
11
10
35
44
41
12
84
86
87
88
13
46
83
89
91
92
93
83
79
94
96
81
97
98
37
39
38
6

FIG. 4

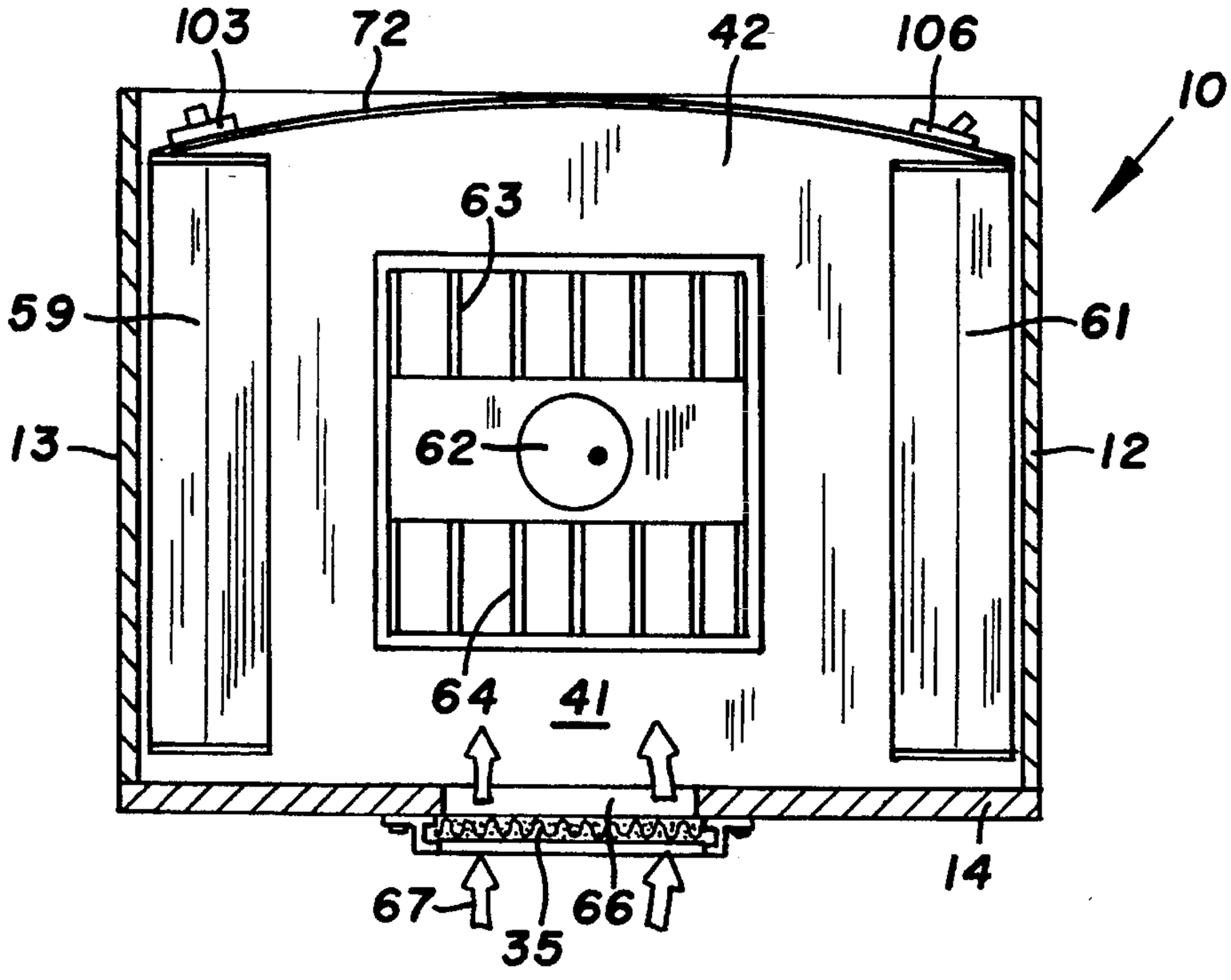

103
72
42
106
10
63
59
61
62
13
12
64
41
67
66
35
14

FIG.5

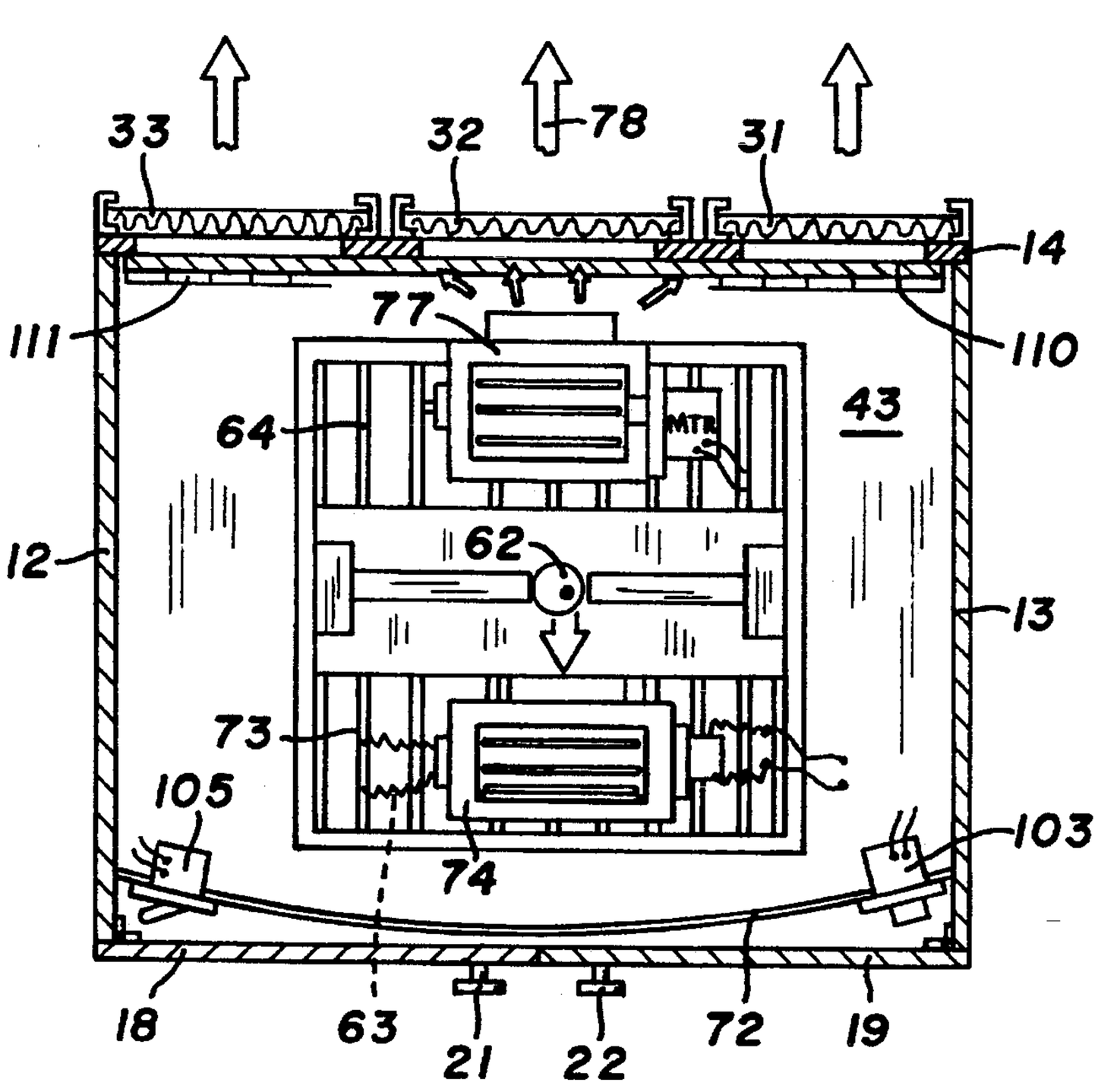

33
32
78
31
14
111
77
110
64
MTR
43
62
12
13
73
105
74
103
18
63
21
22
72
19

FIG.7

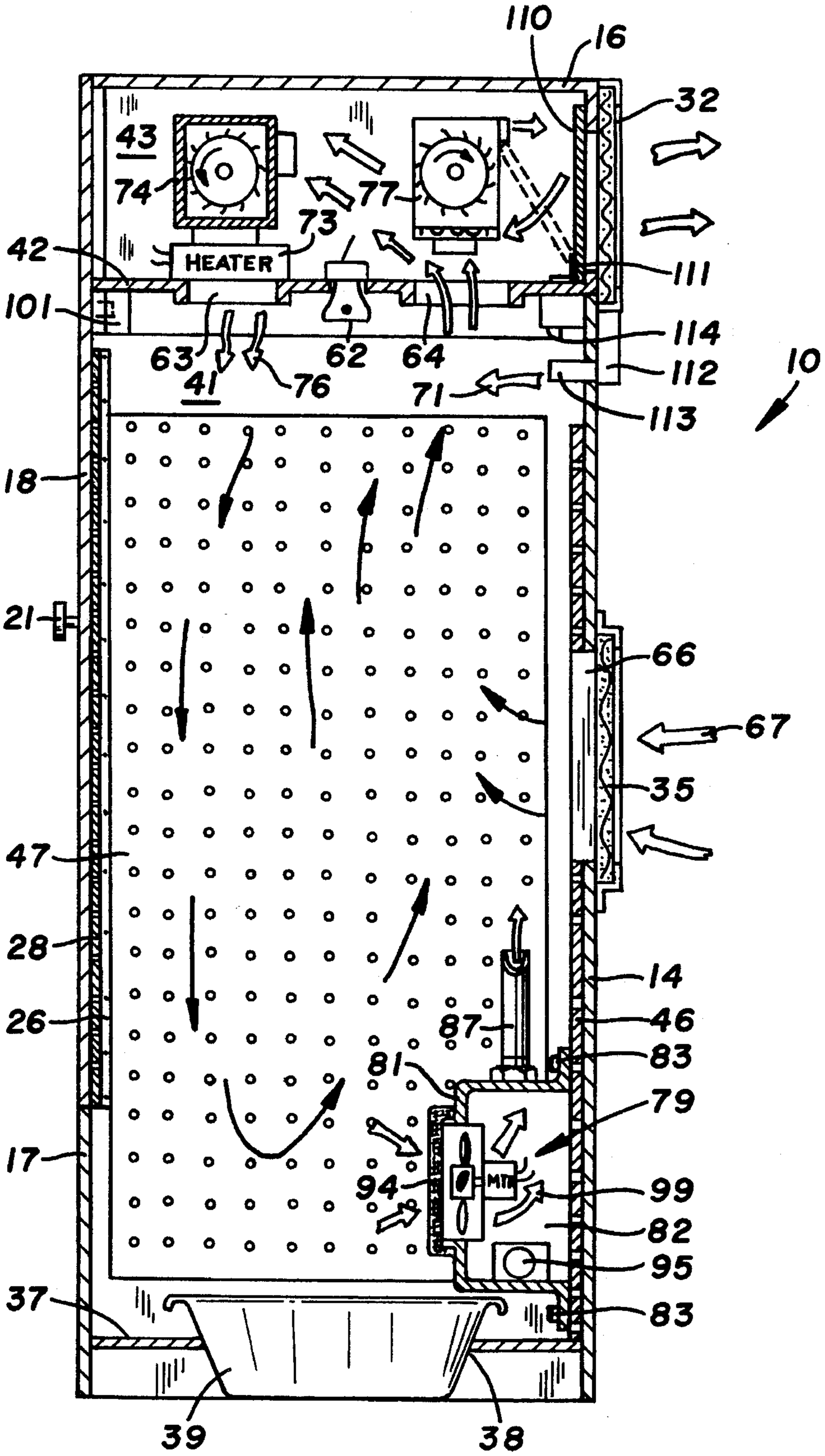

110
16
32
43
74
77
73
HEATER
42
111
101
114
63
62
64
112
10
41
76
71
113
18
21
66
67
35
47
28
26
14
87
46
83
81
79
17
94
MTR
99
82
95
37
83
39
38

FIG.6

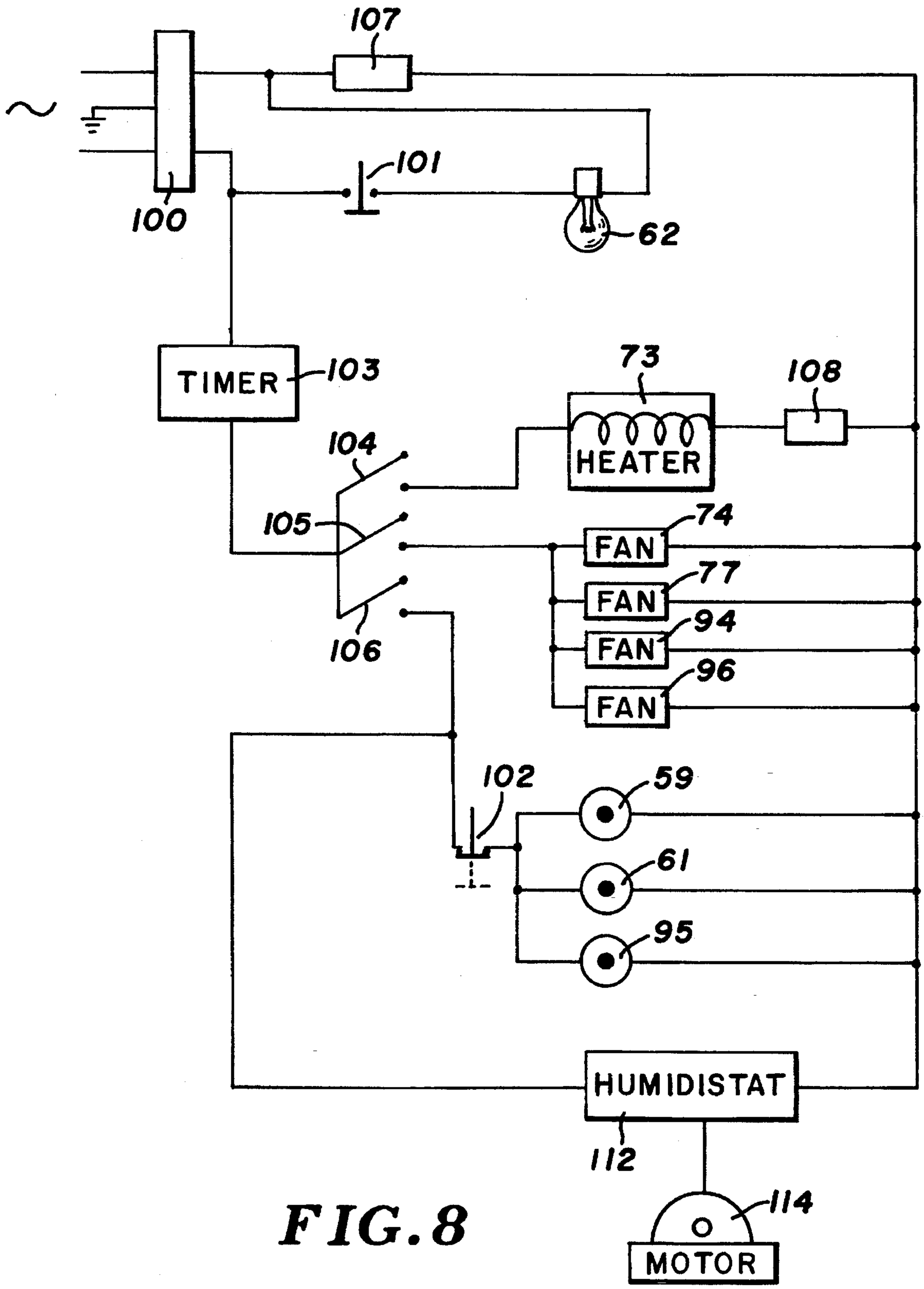

107
101
100
62
TIMER
103
73
108
HEATER
104
105
106
74
FAN
77
FAN
94
FAN
96
FAN
102
59
61
95
HUMIDISTAT
112
114
MOTOR

FIG. 8

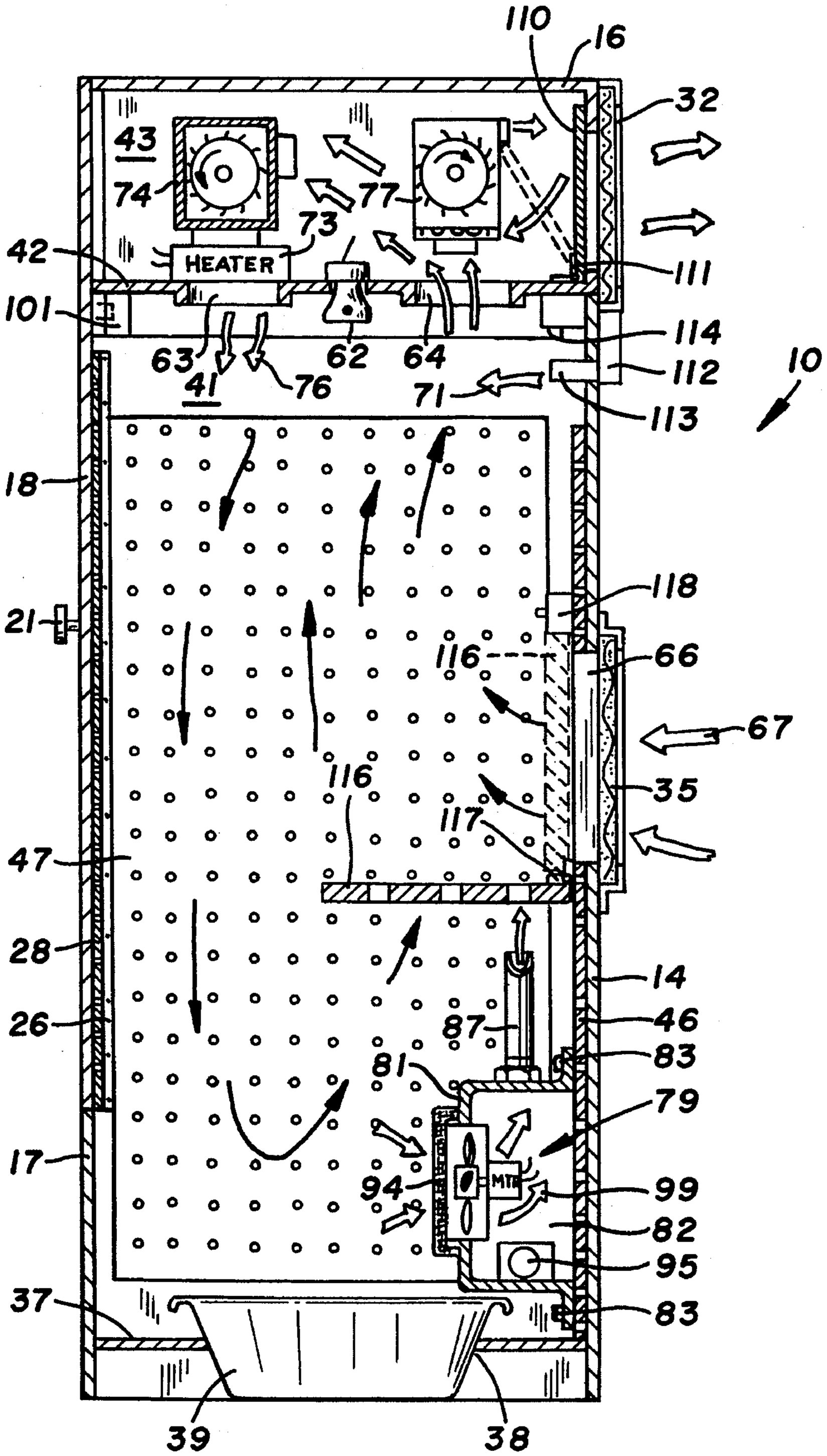

110
16
32
43
74
77
73
42
HEATER
111
101
114
63
62
64
112
10
41
76
71
113
18
118
21
116
66
67
35
117
47
28
14
26
87
46
83
81
79
17
94
MTR
99
82
95
37
83
39
38

*FIG.9*

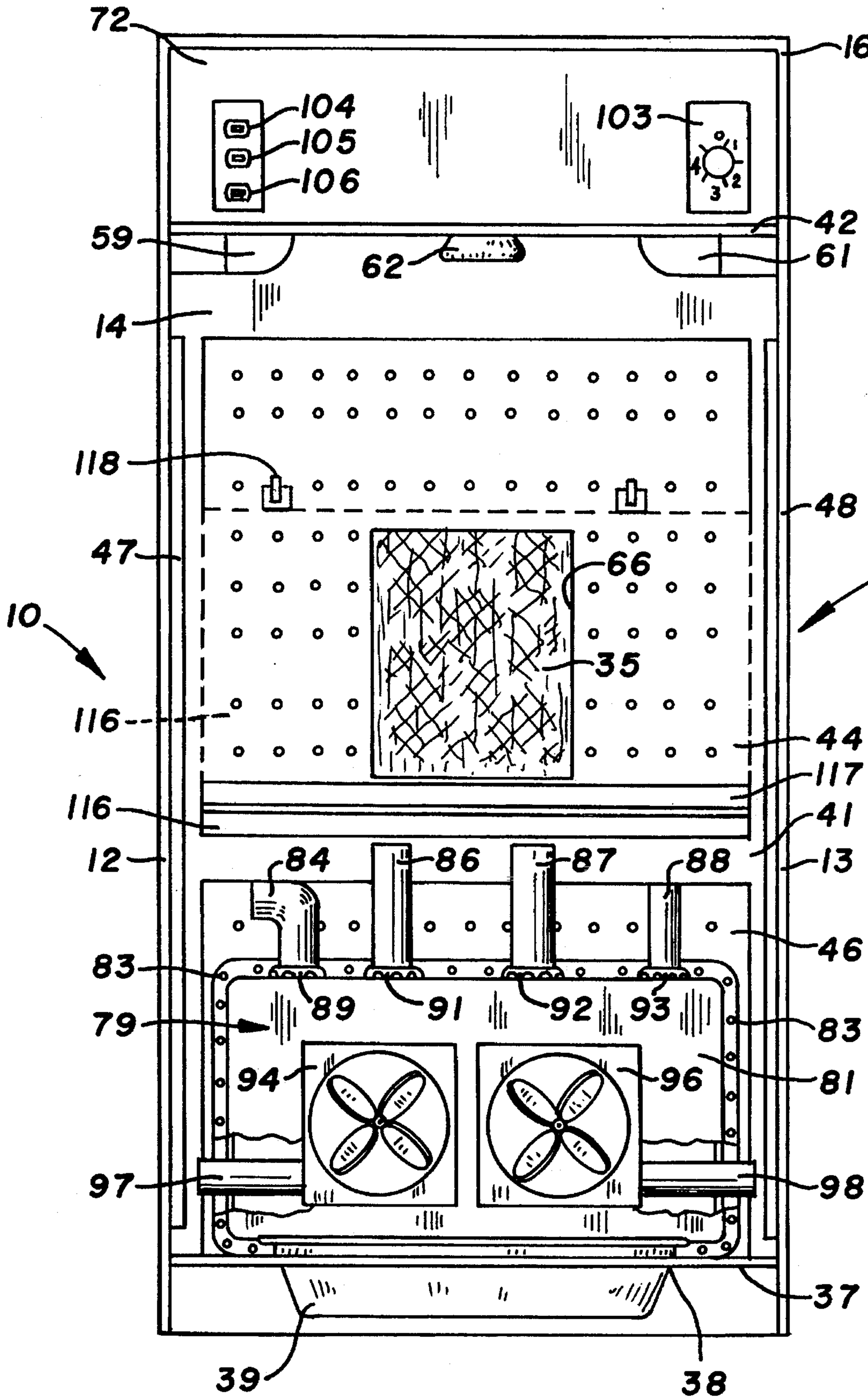

72
16
104
105
106
103
0
1
2
3
4
59
62
42
61
14
118
48
47
66
11
10
35
116
44
117
116
41
12
84
86
87
88
13
46
83
89
91
92
93
83
79
94
96
81
97
98
37
39
38

*FIG. 10*

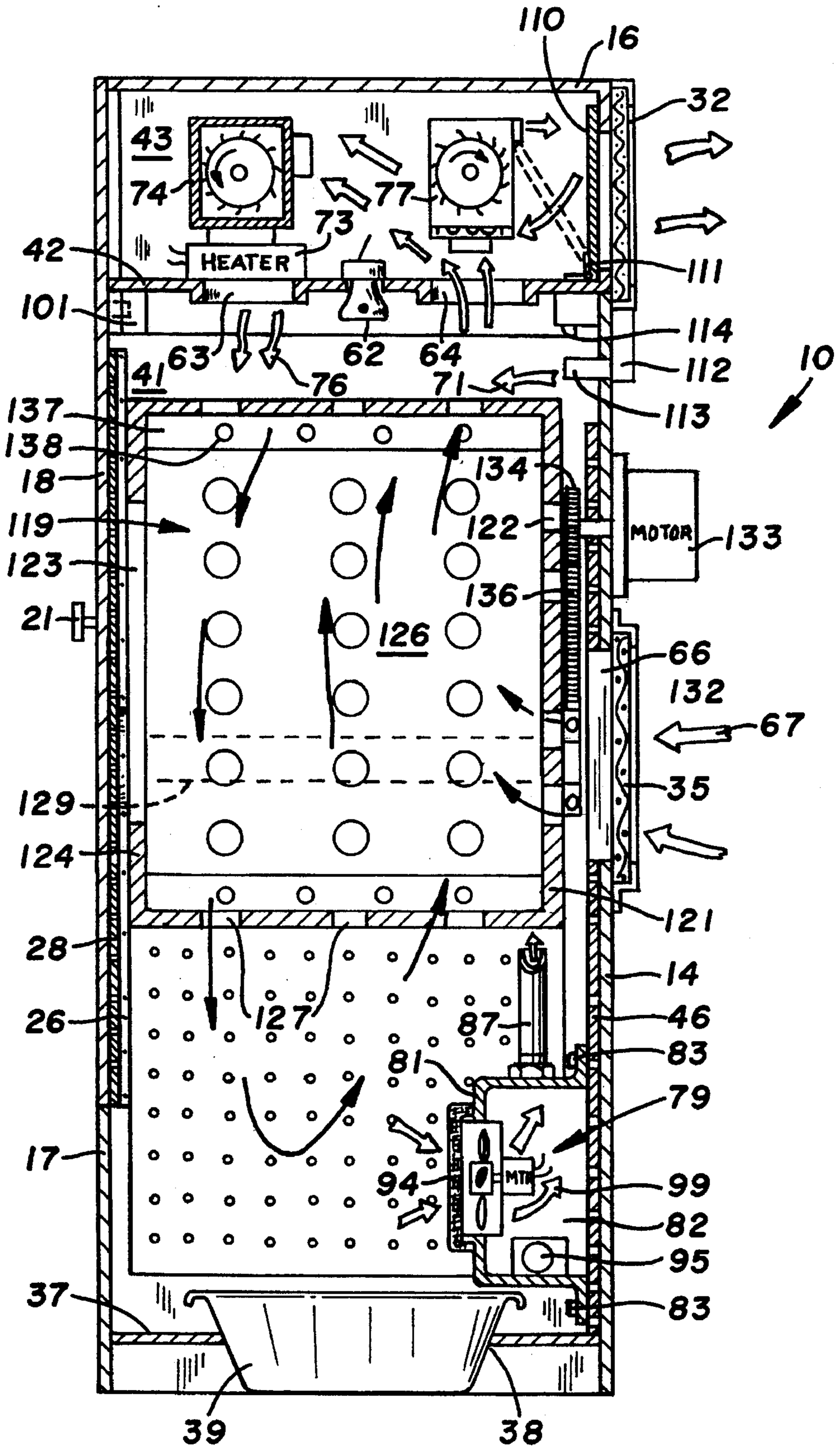

110
16
32
43
74
77
73
42
HEATER
111
101
114
63
62
64
112
10
41
76
71
113
137
138
134
18
119
122
MOTOR
133
123
136
21
126
66
132
67
129
35
124
121
28
14
26
127
87
46
83
81
79
17
94
MTR
99
82
95
37
83
39
38

FIG. 11

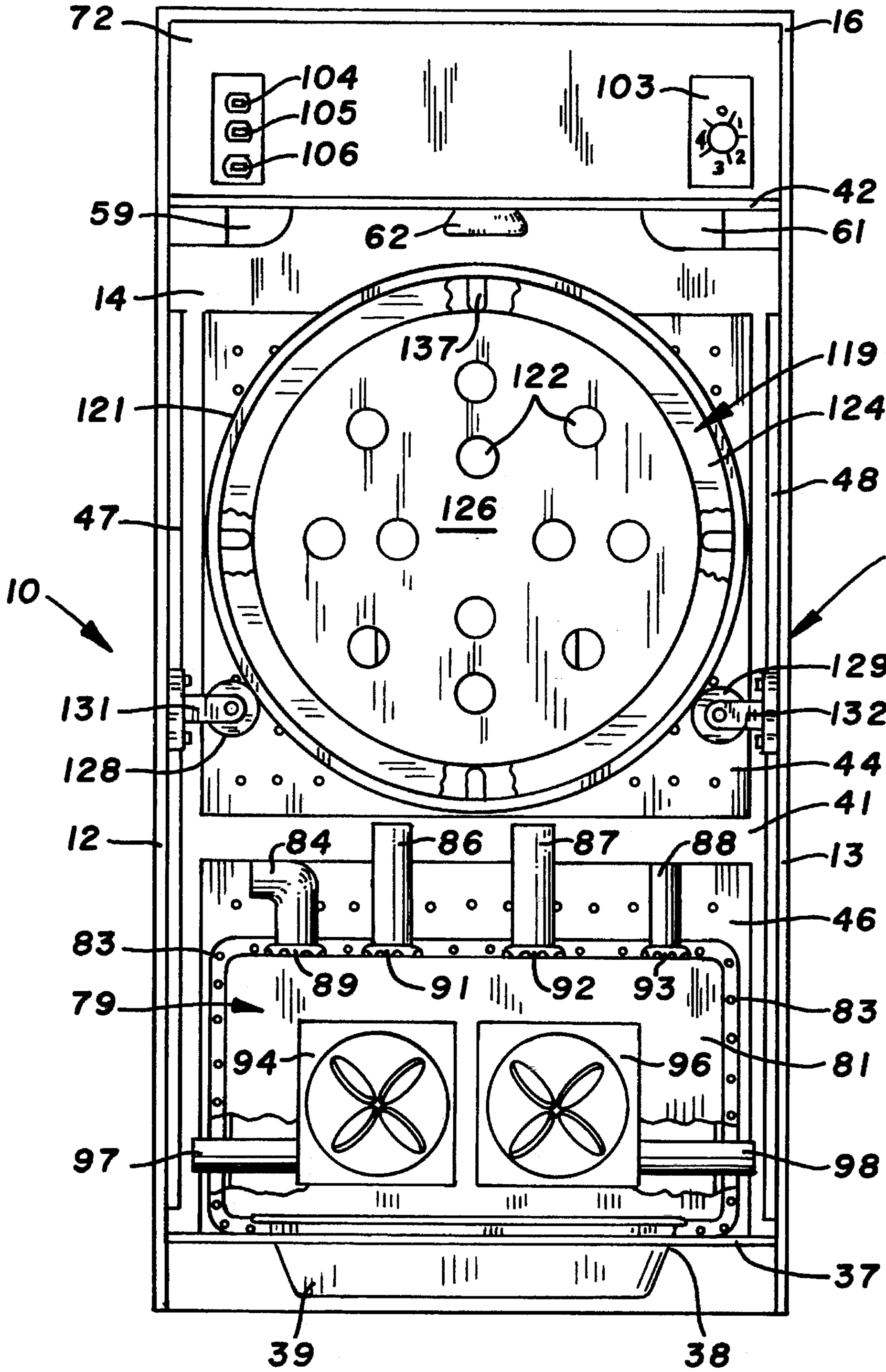

72
16
104
105
106
103
42
59
62
61
14
137
119
122
121
124
126
48
47
11
10
129
131
132
128
44
41
12
84
86
87
88
13
46
83
89
91
92
93
79
83
94
96
81
97
98
37
39
38

FIG. 12

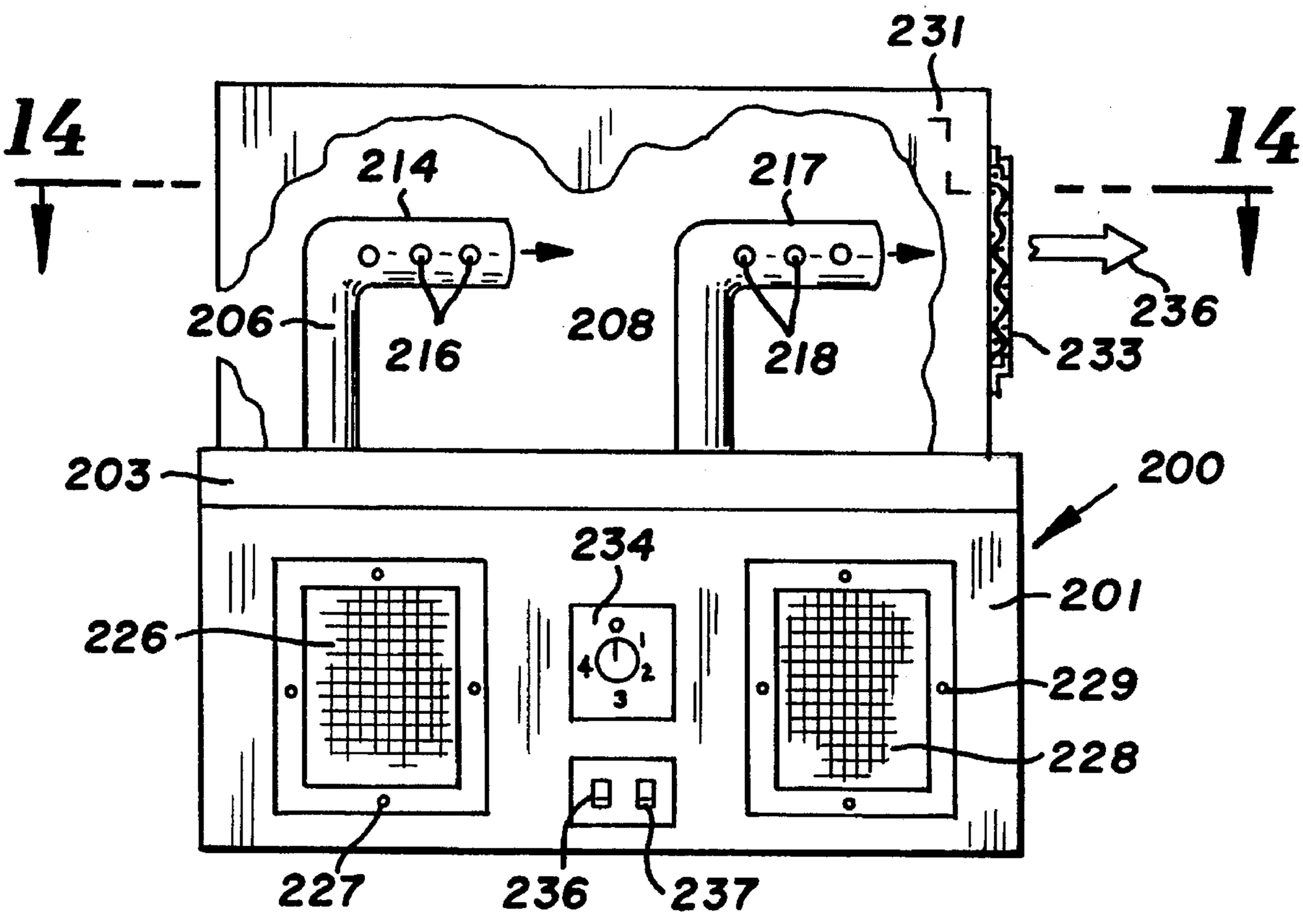

231
14
14
214
217
206
208
216
218
233
236
203
200
234
201
226
229
228
227
236
237

FIG. 13

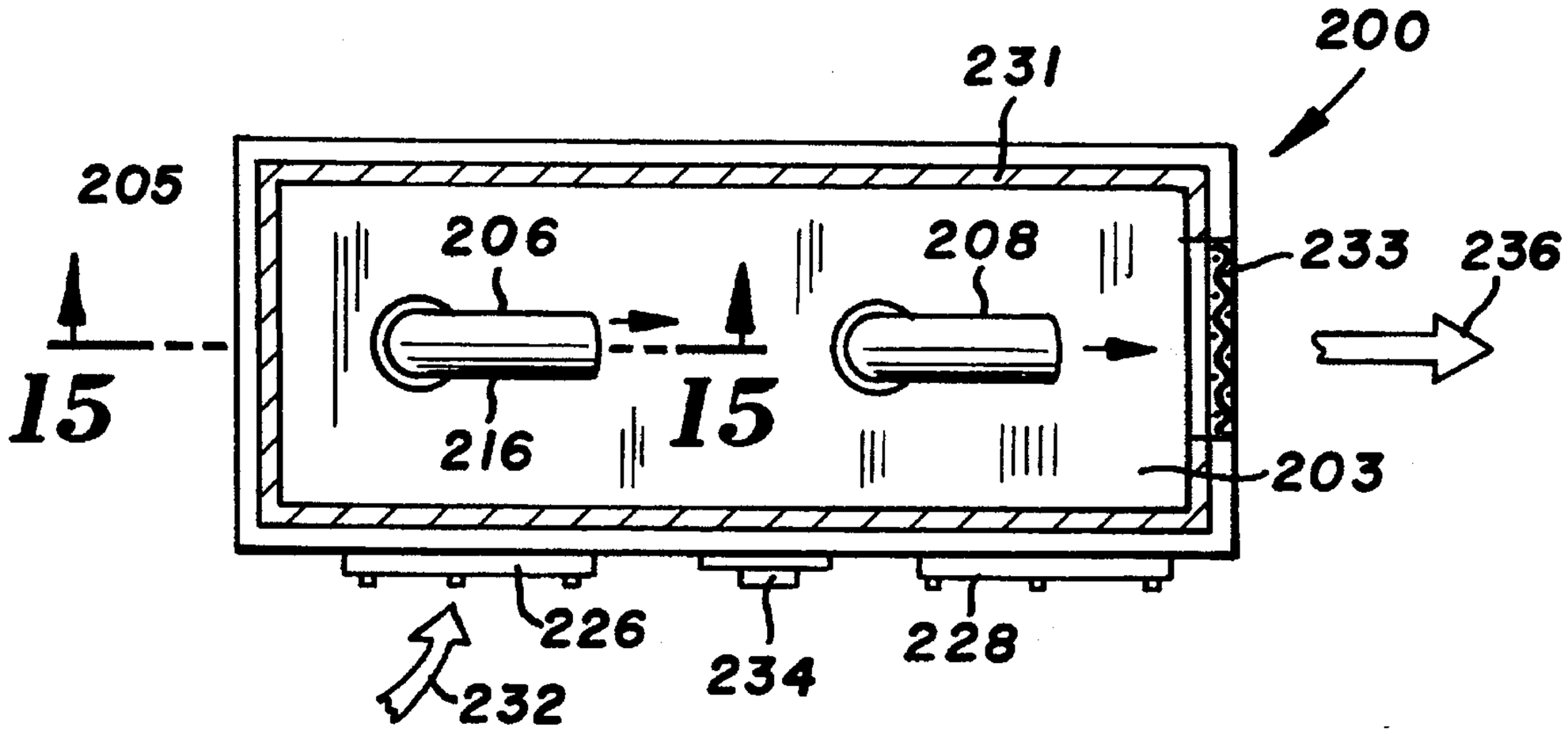

200
231
205
206
208
233
236
15
15
216
203
226
234
228
232

FIG. 14

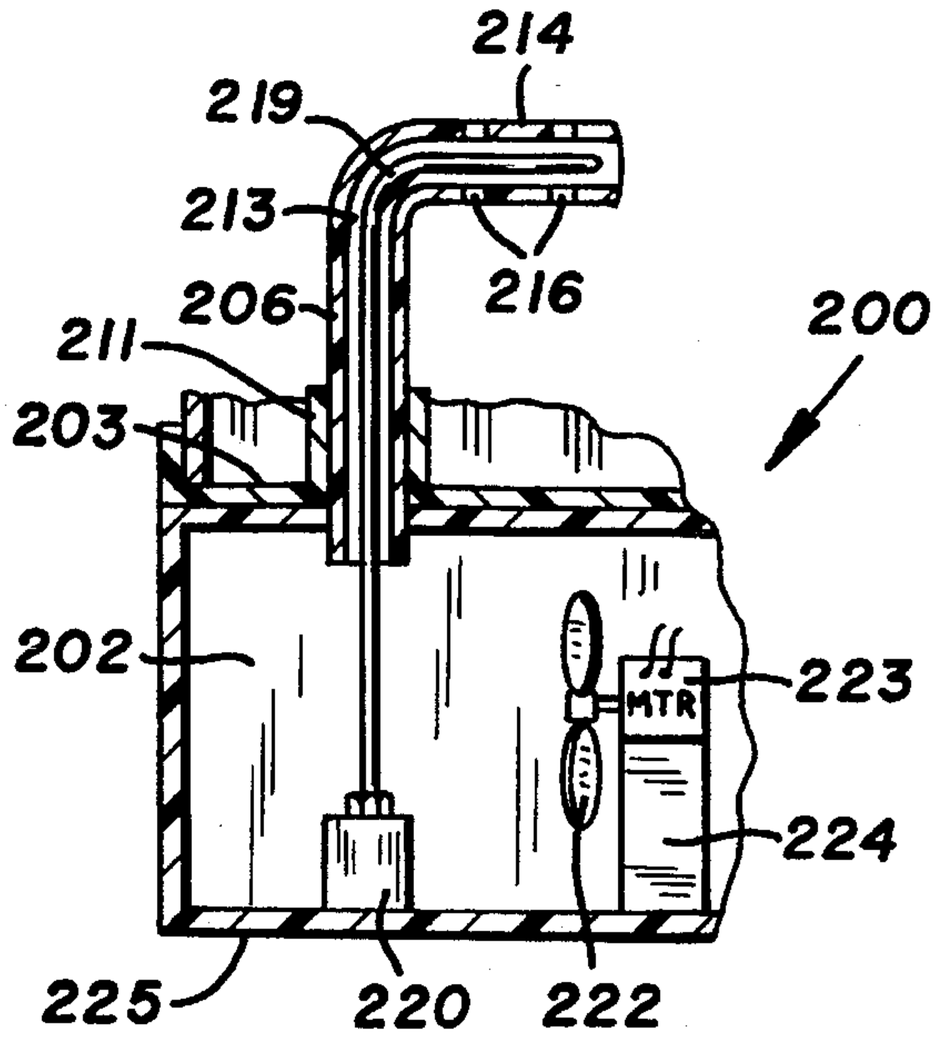

214
219
213
206
216
211
200
203
202
223
MTR
224
225
220
222

FIG. 15

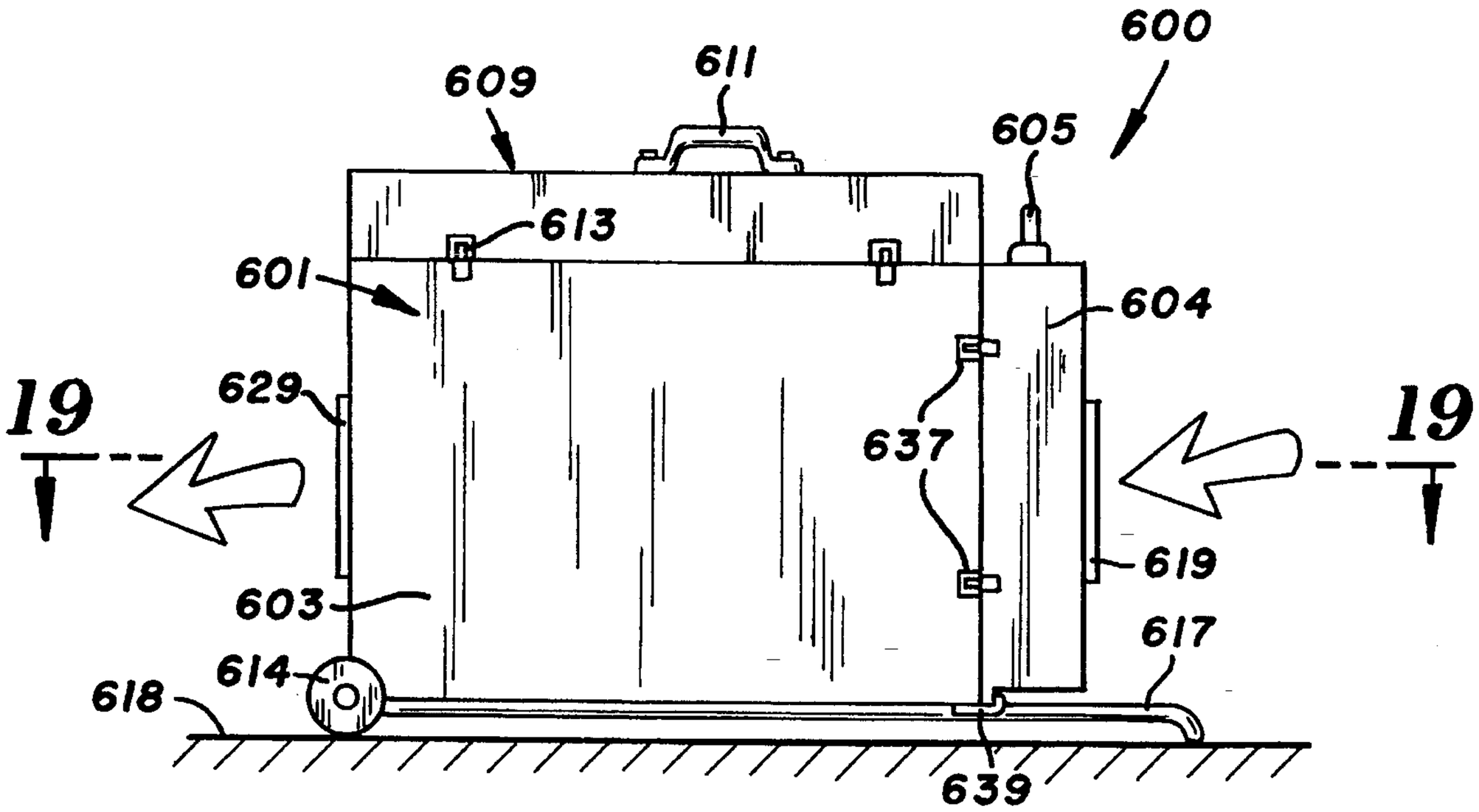

600
609
611
605
613
601
604
19
629
637
19
603
619
617
614
618
639

FIG. 16

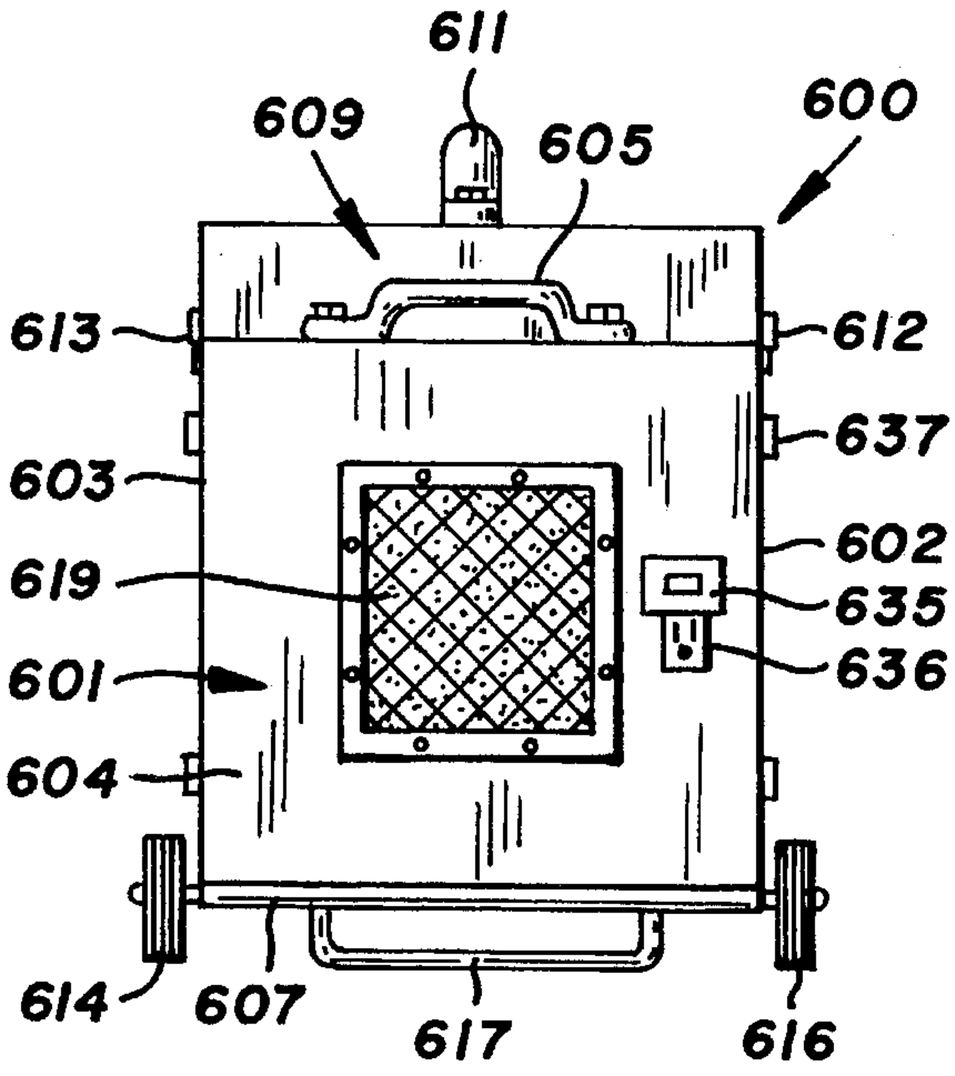



FIG.17

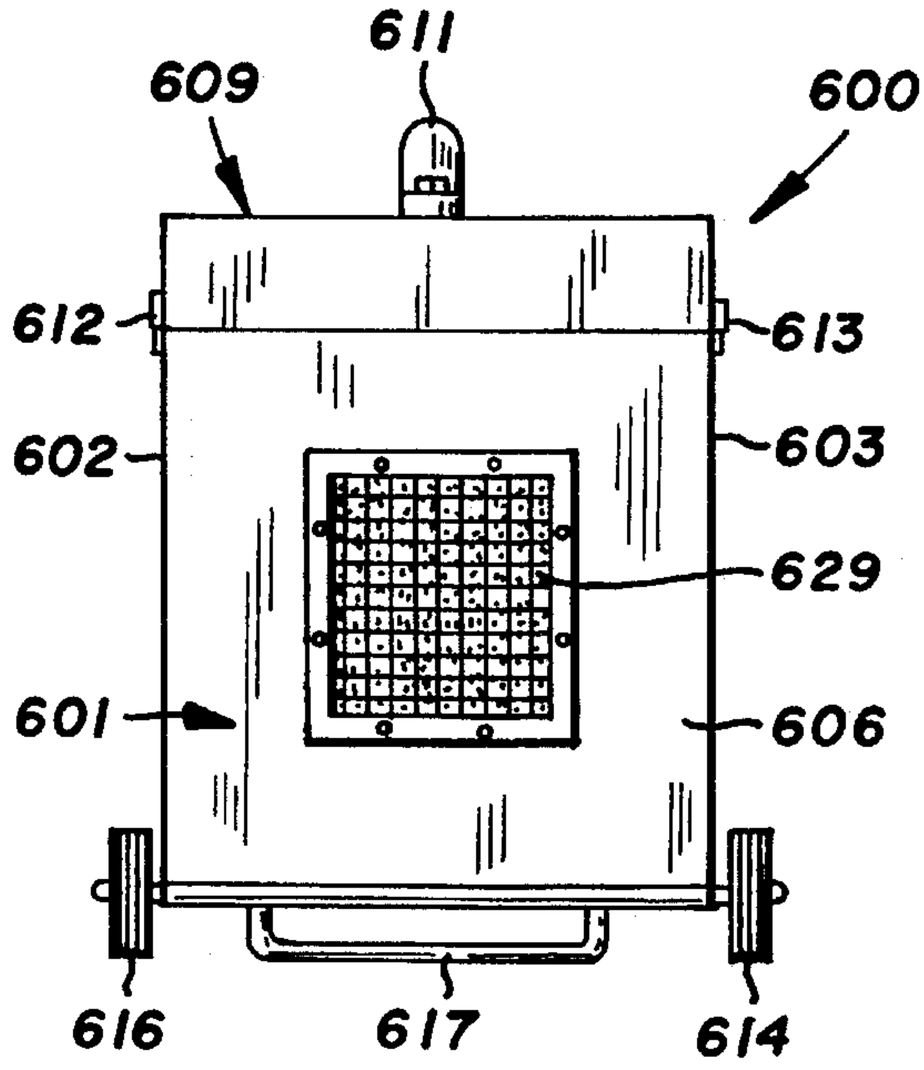



FIG.18




FIG.19

# ARMOIRE ADAPTABLE TO A SAUNA, DRUM DRYER, AND TUBULAR LIGHTED CLOTHING DRYER WITH HUMIDITY DAMPER CONTROL OF EXHAUST GASES

## CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. application Ser. No. 08/072,151, filed Jun. 4, 1993 now U.S. Pat. No. 5,369,892.

## FIELD OF THE INVENTION

The invention is in the field of dryers for drying clothing, sporting and athletic equipment, dry saunas and tanning booths. The drying is achieved by circulating heated air in an enclosed chamber accommodating the articles to be dried.

## BACKGROUND OF THE INVENTION

Wet outdoor garments, sport clothing and equipment have in the past been stored in garages, back rooms and basements where they would eventually dry due to natural air circulation. The natural air circulation is not conducive to rapid drying of articles. The damp articles, such as clothing, will mildew and have unpleasant odors when stored without adequate drying. Cloth drying machines having housings with drying chambers have been used for drying clothes. These machines have heating elements and fans for circulating hot air within the drying chambers to dry the clothes placed in the drying chambers. An example of this type of drying machine is shown by C. J. Liang in U.S. Pat. No. 5,152,077. The machine has a housing having a drying chamber for accommodating clothes. Heated air moving through the drying chamber carries moisture out of the drying chamber into a condensing compartment where moisture is condensed into water and then delivered to an evaporating apparatus and converted into steam. The steam is dried by an electric heater and moved back into the drying chamber. An ultraviolet light is located within the drying chamber for sterilizing the clothes in the drying chamber. Other machines having drying chambers for accommodating heated air for drying clothing are disclosed by A. Irving in U.S. Pat. No. 4,682,424 and J. W. McCormick in U.S. Pat. No. 1,755,013.

## SUMMARY OF THE INVENTION

The invention is directed to a self-contained dryer having an internal chamber for accommodating articles, such as clothing, sporting equipment, hockey gear, shoes and other objects. The dryer has a housing enclosing a drying chamber in which the articles are dried and stored. Doors attached to the housing permit access to the interior of the chamber. Heated air is directed with a first fan into the drying chamber simultaneously with the discharge of air from the drying chamber with a second fan which draws fresh air into the drying chamber and selectively discharges air into an air mixing chamber and to the outside of the dryer. The heated air is recirculated in the drying chamber to increase its moisture content so that the dryer has effective, energy-efficient characteristics. Filters, such as charcoal filters, located adjacent air inlets and outlets, remove airborne odors and particulates from the air moving into and out of the dryer.



The dryer is equipped with a boot dryer, located within the drying chamber. The boot dryer has at least one additional fan that draws air from the drying chamber and discharges the air through tubular members extended into mittens, gloves or footwear, including boots and shoes. The additional fans also recirculate the air in the drying chamber. Ultraviolet lights located in the chamber are used to decontaminate the air. An infrared light is used to provide radiant heat in the drying chamber.

The dryer is adapted to accommodate damp and wet articles of clothing, hunting and sporting equipment including boots, shoes and socks and efficiently and effectively drying these articles. The dryer has a generally upright housing having an internal drying chamber for accommodating the articles to be dried. A pair of doors, hinged to the front of the housing, can be moved to open positions to permit access into the drying chamber so that the articles can be conveniently placed in the drying chamber. The doors are pivoted to their closed positions to enclose the drying chamber. The dryer can have a single door. The drying chamber has a generally horizontal ceiling, which forms with the top wall of the housing and air mixing chamber. Separate portions of the ceiling are provided with openings to allow air to flow from the air mixing chamber into the drying chamber and out of the drying chamber back into the air mixing chamber. An air heater, located in the air mixing chamber, is used to heat air that is supplied to the drying chamber. The heater can be an electric heating coil, an infrared lamp, a microwave heater or other devices used to heat air. A first fan operated with an electric motor is located in the air mixing chamber adjacent the heater. The fan operates to move air from the mixing chamber into the heater and hot air from the heater into the drying chamber. The air is directed downwardly into the drying chamber where it accumulates moisture from the articles located within the chamber. A second fan, located within the air mixing chamber, operates to draw air from the drying chamber and outside air into the drying chamber and discharge air into the mixing chamber or back to the environment outside of the dryer through filters containing charcoal or material to reduce odors from the air. A damper controlled by a humidistat in the drying chamber controls the flow of air discharged into the environment. The first and second fans operate concurrently to continuously circulate and recirculate the air in the drying chamber. The filters contain activated charcoal or materials which removes odors from the air flowing into and out of the dryer. Ultraviolet light fixtures mounted on the ceiling emit UV light that sterilizes the air and articles located within the drying chamber.

A casing, having an internal chamber, is located within the drying chamber to dry mittens, gloves and boot wear, including boots, shoes, skates, in-line roller blade-type skates, socks and the like. A plurality of tubular pipes or members are mounted on the casing and open to the internal chamber of the casing to deliver air into the articles mounted on the tubes. A pair of third fans mounted on the casing operate to move air from the drying chamber through the internal chamber of the casing and tubes to dry the articles thereon. A second ultraviolet lamp, located within the passages of the tubes, directs UV light through the tubes into the articles mounted thereon to destroy bacteria, fungus, mildew and other contaminants present in the air and article on the tube.

The heater and fans are controlled with a plurality of switches and a timer used to select the operating cycle of the dryer. A coin-operated mechanism can be used to control the timer. The control includes a switch connected to germicidal

ultraviolet lights located within the drying chamber for sterilizing and decontaminating the air and articles within the drying chamber. All of the fans are under the control of a single switch so that the fans concurrently operate to move air into and out of the drying chamber, as well as to recirculate the air in the drying chamber. The air discharged from the dryer has a high moisture content resulting in high energy drying efficiency.

A first modification of the dryer includes a bench in the drying chamber to accommodate one or more persons. Infrared light in the drying chamber provides a heat source to heat the air and person in the drying chamber. The dryer is used as a dry sauna. When the ultraviolet lights are used, the dryer functions as a tanning booth. A moisture-producing system, such as a steamer or cool mist humidifier, can be used in the drying chamber to provide a wet sauna.

A second modification of the dryer includes a tumbler, such as an open rotatable drum, for accommodating articles located within the drying chamber. Rollers mounted on the housing support the tumbler for rotation about a generally horizontal axis. A motor releasably coupled to the tumbler rotates the tumbler. The tumbler can be removed from the drying chamber to permit the dryer to be used to dry articles located within the drying chamber. The tumbler has ribs with holes to accommodate hangers for supporting articles when the tumbler is not rotated. Articles, such as sports gear, can be stored and dried in the dryer. The chest is attached to wheels and a handle to facilitate manual handling of the dryer. The top of the drying chamber is closed with a cover hinged to the chest. The cover is movable to an open position to allow access to the drying chamber. Air porous walls within the drying chamber allow air to flow from the drying chamber back to the air mixing chamber for recirculation back into the drying chamber. The air also flows out of the drying chamber through a filter, such as an activated charcoal filter which removes odors from the air.

## DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the dryer of the invention;

FIG. **2** is a rear elevational view thereof;

FIG. **3** is an elevational view of the inside of the doors of the dryer of FIG. **1**;

FIG. **4** is an enlarged front elevational view of the dryer taken along the line **4—4** of FIG. **1**;

FIG. **5** is a sectional view taken along the line **5—5** of FIG. **4**;

FIG. **6** is an enlarged sectional view taken along the line **6—6** of FIG. **4**;

FIG. **7** is a sectional view taken along the line **7—7** of FIG. **4**;

FIG. **8** is an electrical circuit diagram for the heater, fans and lights of the dryer of FIG. **1**;

FIG. **9** is a sectional view similar to FIG. **6** of the dryer equipped with a bench;

FIG. **10** is a front elevational view of the dryer of FIG. **9**;

FIG. **11** is a front elevational view similar to FIG. **6** of the dryer equipped with a rotatable tumbler;

FIG. **12** is a front elevational view of the dryer of FIG. **11**;

FIG. **13** is a front elevational view, partly broken away, of a modification of the boot dryer usable with the dryer of FIG. **1**;

FIG. **14** is a sectional view taken along the line **14—14** of FIG. **13**;



FIG. **15** is a sectional view taken along the line **15—15** of FIG. **14**;

FIG. **16** is a side elevational view of another modification of the dryer of the invention;

FIG. **17** is a front elevational view of FIG. **16**;

FIG. **18** is a rear elevational view of FIG. **16**; and

FIG. **19** is an enlarged sectional view taken along the line **19—19** of FIG. **16**.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. **1** and **2**, there is shown the armoire or dryer of the invention indicated generally at **10**. Dryer **10** is a self-contained structure useable to dry articles and objects including, but not limited to, athletic equipment; such as hockey and baseball equipment, shoes, skates, in-line roller blade-type skates, hand and footwear, boots, socks, recreational and sports clothing and outdoor wear, sweaters, stockings and shirts that at times accumulate body perspiration or fluids, and become damp and wet in inclement weather or wet during laundry cleaning. The term "articles", as used herein, includes, but is not limited to, clothing, athletic equipment and outdoor wear and includes other products and objects that can be dried.

Dryer **10** has a generally rectangular cabinet or housing **11**, including upright side walls **12** and **13**, joined to an upright back wall **14**. A horizontal top wall **16** closes the top of the housing. The front of the housing has a lower front panel **17** located below a pair of doors **18** and **19**. As seen in FIG. **3**, hinges **26** and **27** pivotally mount doors **18** and **19** on side walls **12** and **13** so that the doors can be swung to open positions, as indicated by arrows **23** and **24** to provide full access to the interior of housing **11**. Handles or knobs **21** and **22**, attached to doors **18** and **19** respectively, are used as convenient hand grips to allow doors **18** and **19** to be opened and closed.

As seen in FIG. **3**, peg boards **28** and **29** are secured to the inside surfaces of doors **18** and **19**. Boards **28** and **29** can facilitate hooks and wire basket members for accommodating articles such as items of clothing and other objects to be dried. Other structures, such as walls with grooves, can be used to support articles within the drying chamber **41** of housing **11**. For example, shelves can be used for flat drying of sweaters, shirts and other garments. A drying rack and hangers shown in U.S. Pat. No. 4,582,424 can be used to support articles in drying chamber **41**.

Referring to FIG. **2**, the upper part of back wall **14** carries three filters **31**, **32** and **33**. The air filters are fiber and activated charcoal air filters that can be replaced. The charcoal air filters function to remove odors and particulates from air flowing out of the dryer. Other types of filters can be used to clean the air and remove odors from the air flowing into and out of the dryer. A plurality of clips or holders **34** attach filters **31**, **32** and **33** to back wall **14**. An electrical cord **36** extends through back wall **14** below filters **32** and **33**. Cord **36** is connected to a ground fault circuit breaker **100**, shown in FIG. **8**. An air filter **35** mounted on back wall **14** covers an air inlet opening **66** to filter air flowing into drying chamber **41**, as shown by arrows **67** in FIGS. **5** and **6**. Filter **35** is a charcoal filter operable to remove odors and particulates for the air flowing into the dryer. The air flowing into the drying chamber is mixed with the air circulating in the chamber and makes up for the volume of air discharged through filters **31**, **32** and **33**.

A damper or gate **110**, located in chamber **43**, adjacent filters **31**, **32** and **33**, controls the flow of air through the filters. Damper **110** is normally in the closed position, as shown in full lines in FIG. **6**, closing the openings **109** in wall **14**. The bottom of damper **110** is pivotally connected to wall **42** with a hinge **111**. A humidity sensor or humidistat **112** having an air moisture sensing probe **113** located in chamber **41** is connected to reversible drive motor **114** operable to move to damper **110** between its open and closed positions. Humidistat **112** operates motor **114** to move damper **110** to an open position to allow air to be discharged through filters **31**, **32** and **33**, shown by arrow **78** in FIG. **7**. Humidistat **112** operates in response to the moisture content of the air in drying chamber **41**. When the moisture content of the air in drying chamber **41** is above a selected value, the humidistat **110** will operate motor **114** to open damper **110** thereby discharging air out of chamber **43** and allowing outside air to flow into drying chamber **41**.

As seen in FIG. **4**, a bottom wall or floor **37** is attached to lower portions of side walls **12** and **13** and back wall **14**. Bottom wall **37** has a large central opening **38** accommodating a drip pan **39**. Drip pan **39** has an open top to accommodate any water, ice or snow that is derived from the articles to be dried within housing **11**. The articles are located within a drying chamber, indicated generally at **41**, located above drip pan **39**. The upper part of housing **11** has a ceiling or transverse wall **42** located below an air mixing chamber **43**, as seen in FIG. **6**.

The inside of back wall **14** accommodates a generally rectangular peg board **44** and a lower peg board **46**. Boards **44** and **46** can be a single peg board. Peg boards **47** and **48** are secured to the insides of side walls **12** and **13**. Article support structures or clips can be used to support shelves, hooks and other structures for supporting the articles within chamber **41**. Rotatable cylinders can be placed in chamber **41** for holding articles as hereinafter described.

A pair of germicidal ultraviolet light fixtures **59** and **61** are located in the upper corners of drying chamber **41**. Fixtures **59** and **61** are attached to opposite sides of the lower side of transverse wall **42**. The ultraviolet light emitted from fixtures **59** and **61** functions to sterilize or decontaminate the air within chamber **41** and limit mold, fungus, virus, mildew, dry rot and bacterial growth on the articles to be dried.

The center of transverse wall **42** supports a light **62**, such as an infrared light, and air grills **63** and **64**, allowing air to circulate between drying chamber **41** and mixing chamber **43**. The infrared light functions to heat the air, moisture and articles located in drying chamber **41**. The heat aids in removing moisture from the articles. Back wall **14**, as seen in FIGS. **4** and **6**, has an opening **66** covered by filter **35** to allow outside air to flow into drying chamber **41**. A motor-driven fan (not shown) can be mounted on back wall **14** to force additional outside air into drying chamber **41**. Arrows **67** indicate the flow of air into chamber **41**. Opening **66** allows outside air to flow into drying chamber **41** so that the dryer breathes when used for storage.

A front panel **72** closes the front portion of mixing chamber **43**. Panel **72** supports a timer **103** and switches **104**, **105** and **106** for controlling heater **73**, ultraviolet lamps **59**, **61** and **95**, humidistat **112** and fans **74**, **77**, **94** and **96** used to circulate air in drying chamber **41** and air mixing chamber **43**. A coin-operated mechanism (not shown) can be used to operate timer **103**.

As seen in FIG. **6**, a first fan or blower **74**, having a squirrel-cage impeller driven with an electric motor, operates to deliver air through heater **73** and into drying chamber **41**, as indicated by arrows **76**. Heater **73** is shown as an electric resistance coil located between fan **74** and air grill **63**. Other types of heaters including infrared light and electronic heaters can be used to heat air directed into drying chamber **41**. A microwave-type heater can be used to heat the air and articles in heater **41**. Fan **74** and heater **73** can be a single device mounted on interior wall **42**. A second exhaust fan **77**, having a squirrel-cage impeller driven with an electric motor, operates to draw air from drying chamber **41** and discharge the air toward charcoal air filters **31**, **32** and **33** for discharge into the atmosphere, as indicated by arrows **78**. A single electric motor can be used to drive fans **74** and **77**. As shown in FIG. **6**, outside air is drawn through air filter **35** to make up for the air that is discharged through air filters **31**, **32**, and **33** by the operation of fan **77**. Fan **77** draws air from drying chamber **41** through air grill **64** and draws fresh, external air through air filter **35** and hole **66**. This air is mixed with air from drying chamber **41** in chambers **41** and **43** and is discharged through heater **73** and air grill **63** into the top of drying chamber **41**. The hot air from drying chamber **41** heats up the cool, fresh air thereby reducing the amount of heat energy required by heater **73** to heat the air being forced into drying chamber **41** by fan **74**.

As seen in FIGS. **4** and **6**, a second drying unit termed a boot dryer, indicated generally at **79**, is located in the lower portion of drying chamber **41** adjacent back wall **14**. Boot dryer **79** has a housing or casing **81** that is attached with fasteners **83**, such as bolts, to back wall **14**. Boot dryer **79** can be positioned at a selected elevation relative to back wall **14**, as desired by the user of the dryer. Casing **81** has an internal chamber **82** that is open to a plurality of upright tubes **84**, **86**, **87** and **88**. Sleeves with tightening nuts **89**, **91**, **92** and **93**, secured to the top wall of casing **81**, accommodate lower ends of tubes **84**, **86**, **87** and **88** so that the tubes can be removed and replaced with tubes having shapes that accommodate different types of mittens, gloves, boots, shoes, skates and the like. The sleeves associated with nuts **89**, **91**, **92** and **93** allow for vertical adjustment and circumferential positioning of tubes **84**, **86**, **87** and **88** to accommodate different types and sizes of articles. FIG. **4** shows tubes having different shapes and elevations that can be selectively attached to casing **81**. An ultraviolet lamp **95** within casing **81** emits light to the casing and through tubes **84** and **86–88** to destroy contaminants in the air and articles located on the tubes. The front wall of casing **81** accommodates a pair of third and fourth fans or blowers **94** and **96** having blades rotated with electric motors to draw air from drying chamber **41** into boot dryer chamber **82** which is then forced through tubes **84**, **86**, **87** and **88** into the boots or like objects that are mounted on the tubes. Fans **94** and **96** also operate to discharge air laterally through tubes **97** and **98** into the lower portions of drying chamber **41**, as indicated by arrows **99** in FIG. **6**, to increase air circulation within the lower portion of drying chamber **41**. A single fan can be used in lieu of fans **94** and **96**. The direction of rotation of the fan blades associated with fans **94** and **96** can be reversed so that the air is drawn into tubes **84**, **86**, **87** and **88** and discharged into drying chamber **41**.

Referring to FIG. **8**, there is shown the electrical circuit diagram for heater **73**, fans **74**, **77**, **94** and **96**, humidistat **110** and lights **59**, **61** and **62** of dryer **10**. A switch **101** functions to connect light **62** with the power source connected to ground fault circuit breaker **100**. The operator of the dryer uses switch **101** to turn light **62** ON and OFF. Timer **103** is directly connected to three switches **104**, **105** and **106**. Switch **104** is operable to connect the power to heater **73**. Switch **105** is operable to connect the power to all of the fans

74, 77, 94 and 96 so that the fans simultaneously operate to circulate and recirculate the air in the drying chamber and concurrently mix the air from the drying chamber with outside air in mixing chamber 43. Fans 94 and 96 also operate to move the air through the boot dryer as they draw air from the lower portion of the drying chamber.

Switch 106 is electrically connected to ultraviolet lights 59 and 61. A door-operated switch 102 is interposed in the line between switch 106 and lights 59 and 61. Switch 102 is normally closed when door 18 is closed. When door 18 is open, the switch is opened so that ultraviolet lights 59, 61 and 95 are OFF when door 18 is open.

The electrical circuit includes an adjustable humidistat 107 that senses the humidity of the air in drying chamber 41. When the humidity in the drying chamber 41 is below a selected limit, humidistat 107 will automatically open and thereby terminate the power to the timer and shut the entire system OFF. The electrical circuit also includes an adjustable thermostat 108 which is normally closed. When the temperature of the air within drying chamber 41 exceeds a pre-determined limit, thermostat 108 will open and thereby terminate the power to heater 73. The fans and ultraviolet lights remain ON. When the temperature in drying chamber 41 drops below a selected point, heater 73 is turned ON. Thermostat 108 is adjustable to change the upper and lower limits of the air temperature within drying chamber 41.

When switch 106 is closed, humidistat 110 is energized to sense the moisture content of the air in chamber 41 and controls the motor 114 and open and closed portions of damper 110. When the moisture content of the air in chamber 41 is below a selected value, the motor 114 holds the damped closed. The air in chambers 41 and 43 continues to circulate thereby pushing up additional moisture from the articles in chamber 41. The humidistat 110 controls motor 114 which opens damper 110 when the moisture content of the air in the chamber, as sensed by probe 113, is above or greater than a selected value. This allows air to be discharged from chamber 43 and permits fresh air to flow into chamber 41.

In use, doors 18 and 19 are moved to open positions to provide access to drying chamber 41. The articles, such as clothing, shoes and the like are placed within drying chamber 41 on suitable trays or hangers. The boots, shoes, skates and socks are placed over tubes 84, 86, 87 and 88 so that they can receive the air flowing through the tubes. Ultraviolet lights 59, 61 and 95 are OFF, as door-operated switch 102 is open or timer 103 is OFF. Light 62 is ON as door-operated switch 101 is closed when door 18 is open. Switches 104, 105 and 106 are turned to the ON position. Timer 103 is then set to a selected time, such as 30 minutes, to provide a definite drying duration. When switch 104 is closed, heater 73 operates to heat the air flowing through the heater. Switch 105, when closed, operates all of fans 74, 77, 94 and 96. Fan 74 drives the air from mixing chamber 43 through heater 73 and to the upper portion of drying chamber 41. Fan 77 draws air from drying chamber 41 and discharges the air through filters 31, 32 and 33 into the atmosphere. Part of the air drawn through air grill 64 flows into fan 74 and is recirculated in drying chamber 41. Outside air is drawn through filter 35, as seen in FIG. 6, and mixed with the air in drying chamber 41. The air in chamber 43 is moved by fan 77 through heater 77 into drying chamber 41. Fans 94 and 96 operate to move air from the lower portion of the drying chambers through the boot dryer into tubes 84–88 that accommodate the shoes, skates, boots and the like that are mounted thereon. The air flowing through the boots, skates, shoes and the like pick up moisture from the insides of these goods to facilitate the internal drying thereof. The UV light from ultraviolet lamp 95 destroys contaminants in the air and articles mounted on tubes 84–88. Fans 94 and 96 also recirculate air to the lower portion of drying chamber 41 through lateral tubes 97 and 98, as seen in FIG. 4. When switch 106 is closed, ultraviolet lights 59, 61 and 95 are ON. Subjecting the air and articles within the chamber and retained on tubes 84, 86, 87 and 88 to ultraviolet light has a decontamination effect thereon. When the humidity of the air in the drying chamber drops below a selected value, humidistat 107 will turn the system OFF. Thermostat 108 will turn heater 73 OFF when the temperature of the air exceeds a pre-determined value and turns heater 73 ON when the air temperature drops below a set point. Thus, the dryer will not over-dry the articles located in drying chamber 41 nor will the temperature of the air within the drying chamber exceed a selected value, as determined by the thermostat.

Referring to FIGS. 9 and 10, there is shown the dryer 10 equipped with a bench or seat 116. A transverse hinge 117 pivotally connects seat 116 to the upright wall 14 below filter 35. Seat 116 extends outwardly over boot dryer 79. Hinge 117 allows seat 116 to be pivoted upwardly to a generally vertical position, as shown in broken lines, to close the opening 66. A plurality of latches 118 functions to hold seat 116 in an upright position. Seat 116 is folded up against the back wall so that the dryer can be used as a drying systems. When seat 116 is in its generally horizontal position, dryer 10 can be used as a dry sauna, tanning booth or a product or clothes dryer. The ultraviolet lights 59 and 61 can be of the type used in tanning booths. The infrared light 62 generates radiant heat to the person within chamber 41. A humidity or moisture-producing unit can be included in chamber 41 to use dryer 10 as a wet sauna.

Referring to FIGS. 11 and 12, there is shown the dryer 10 equipped with a tumbler, indicated generally at 119, for accommodating articles, such as wet clothes, to be dried. Tumbler 119 is located in chamber 41. Tumbler 119 has a cylindrical cage 121 having a plurality of holes 127 that allow air to flow into and out of a chamber 126. The rear end of cage 121 is attached to a generally circular end wall 122 having a plurality of holes facing the filter 35. The front end of cage 121 has a large circular opening 123 that is formed by a cylindrical or annular flange 124. Cage 121 is rotatably supported in chamber 41 with a plurality of horizontal rollers or roll bars 128 and 129. Brackets 131 and 132 rotatably hold rollers 128 and 129 on the side walls 14 and 17. Rollers 128 and 129 allow the cage 121 to be removed through the open door of the dryer.

A motor 132, having a drive gear 134, is located in driving engagement with an gear 136 secured to cage 121. Motor 133 operates to rotate cage 121 about a generally horizontal axis. Cage 121 can be rotated with a motor located below the cage and a belt drive. Other types of drive systems can be used to rotate tumbler 121.

As seen in FIGS. 11 and 12, cage 121 has a plurality of longitudinal ribs 137 having a plurality of holes 138. Hangers or other support structures can be mounted on the ribs 137 to dry articles located on the hangers. Cage 121 is not rotated during the drying of articles located on hangers attached to the ribs 137. The heater 73 heats the air that is discharged from the blower 74 into the drying chamber 41. The air flows through the chamber 126 of the cage 121 and is withdrawn from cage 121 and chamber 41 with blower 77. Make up air flows through filter 35 into chamber 41 when damper 110 is open.

Cage 121 is rotated about a horizontal axis that extends from the front to the rear of chamber 41. An alternative cage

structure can be located for rotation about a horizontal axis between the side walls of the dryer.

Referring to FIGS. **13–15**, there is shown a modification of the boot dryer, indicated generally at **200**, usable with dryer **11** or independently of the dryer. Boot dryer **200** can replace boot dryer **79** located within drying chamber **41**. Dryer **200** is used to remove moisture and odors from shoes, skates, boots, in-line roller blade-type skates, socks, gloves, mittens and other hand and foot wear.

Dryer **200** has a generally rectangular casing **201** enclosing an internal chamber **202**. A drip pan or tray **203** is located on top of casing **201** to collect any water, snow, ice, mud or the like that may fall from the articles being dried. Tray **201** is generally pan-shaped with four laterally located upright bosses **204** and a peripheral outer upright side wall **205**. Upright tubes **206** and **208** extend through tubular bosses **204** down into chamber **202**. As seen in FIG. **14**, split clamp collar **211**, located about tube **206**, is retained thereon with bolt **212**. The collar allows tube **206** to be vertically adjusted. Tube **206** can also be circumferentially located to accommodate different types and styles of articles to be placed thereon. Other types of holding structures can be used to retain tube **206** on casing **201**. Tube **206** has an upright continuous passage **213** to allow air to flow through tube **206**. The upper end **214** of tube **206** extends laterally to fit into a boot or shoe to direct air into the interior of the shoe. End **214** has a number of holes **216** to direct air toward the sides of the interior of the boot or shoe. Tube **208** has a lateral end **217** with holes **218** to distribute air in another boot, shoe or socks. Each tube **206** and **208** has an open outer end for directing air to the interior of the article located over the tube.

Returning to FIGS. **13** and **14**, the tubes **208** and **208** are covered with a hood or housing **231** resting on tray **203**. One or more air filters **233** mounted on hood **231** allow air to flow from the inside of hood **231** to the external environment, as shown by arrow **236**. Filters **233** can include activated carbon or like materials to remove odors from the air flowing through the filters.

As seen in FIG. **15**, an ultraviolet lamp **219**, located within chamber **202** and mounted on a fixture **220**, is axially aligned with passage **213** and extends up into passage **213** and end **214**. Lamp **219** emits ultraviolet light into passage **213**. Tube **205** is made of material that allows the ultraviolet light to pass to the interior of the article mounted on tube **206**. Thus, the ultraviolet light is directed to the body, toe and heel sections of the boot, socks or the like that are placed on tube **206**. The ultraviolet light has a germicidal and disinfectant effect on contaminants including bacteria, spores, fungus, viruses and the like that may be present in the article located on tube **206** and the air flowing therethrough. Tube **208** has the same structure as tube **206**. Dryer **200** can have one or more tubes having shapes to accommodate the articles to be mounted thereon.

Air is drawn into chamber **202** with fan **222**, operated with electric motor **223**. Support or stand **224** locates fan **222** in alignment with an opening in casing **201** covered with filter **226**, such as an activated charcoal filter. A plurality of fasteners **227**, as seen in FIG. **13**, secures filter **226** to casing **201**. A second filter, such as an activated carbon filter **228**, is located on casing **201** and attached thereto with fasteners **229**. Filter **228** covers an opening in casing **201** open to chamber **202**. A second fan driven by a motor (not shown) is located behind filter **228** to move air through filter **228**. An example of this fan and motor is fan **222** and motor **223**, as shown in FIG. **15**. Other types of structures, such as blowers, impellers and the like, driven by motors, can be used to move air through filters **226** and **228**.

Returning to FIG. **13**, timer **234** is mounted on the center portion of casing **201** between filters **226** and **228**. Timer **234** is used to set the interval of time on the operation of the fan **222** that move the air into tubes **206** and **208**. Fan **222** can be used to draw air into tubes **206** and **208**. The incoming air flows into the articles, such as a boot, shoe or the like to be dried and through hood **231** and filter **233** into the external environment. The external air indicated by arrow **232** can be heated with a heating coil (not shown) located within chamber **202**. Other types of heating structures can be used to heat the air used to dry articles mounted on the tubes. A heater can be located within chamber **202** adjacent fan **222** and move air into tubes **206** and **208** and through articles mounted thereon. This air picks up the moisture, as well as the odors from the article that is being dried. The air moving through filters **226** and **228**, which contain odors, removes the odors from the air. The motor **223** for the fan is connected to an electrical power source via switches **236** and **237**. Switches **236** and **237** can be simultaneously turned ON or individually turned ON to control the flow of air through tubes **206** and **208** into and out of chamber **202** and through filters **226**, **228** and **233**.

When dryer **200** is used with dryer **11**, motors **223** for fan **222**, can be directly connected to switch **105** so that the exhaust and recirculating fans **74** and **77** operate concurrently with boot dryer motors **223**.

Referring to FIGS. **16–19**, there is shown a modification of the dryer of the invention, indicated generally at **600**. Dryer **600** is a movable and portable structure usable to dry and store articles, such as clothing, athletic equipment and recreational products. Dryer **600** has a box-shaped housing or chest, indicated generally at **601**, comprising upright side walls **602** and **602** joined to an air inlet housing **604**. The air flows out of the chest through an air outlet end wall **606**. A generally flat bottom wall **607** closes the bottom of the chest **601** and provides the bottom for a drying chamber **608**, as seen in FIG. **17**. The walls of chest **601** are rigid structures made of wood, plastic and paper material. Flexible plastic, fabrics or canvas can be used for chest **601**. The top of drying chamber **608** is closed with a top member or cover, indicated generally at **609**. A handle **611**, attached to cover **609**, is used to open the cover and/or transport the dryer. Other handles and straps can be used to conveniently carry the dryer. Hinges **612** pivotally connect cover **609** to side wall **602**. The opposite side of cover **609** accommodates latches **613** that secure cover **609** to side wall **603**. Casing **601** has a front end wall **622** that supports a filter **623**. Filter **623** is a charcoal filter that filters the air moving into the drying chamber, as indicated by the arrows **627**. The outer wall **606** has a charcoal filter **629** that filters the air flowing from the drying chamber into the atmosphere, as indicated by the arrows **633**.

Housing **604** is removably mounted on the front end of casing **601** so that it can be detached from the casing. This allows the casing to be independently transported. Located within housing **604** is a fan **624** driven by an electric motor **626**. A heater **628**, located in front of fan **624**, heats the air moving through the grill **619** mounted on the front wall of housing **604**. Fan **624** is a blade-type fan or an impeller fan that is operable to provide a continuous supply of air to drying chamber **608**. Other types of air moving structures, such as a cylindrical blower, can be used to move the air through the filter **623** into the drying chamber **608**. A switch **634**, mounted on the front wall of housing **608**, is used to control a supply of electric power to the motor **626**. As seen

in FIG. **14**, an electric plug receptacle **636** is mounted on housing **604** below switch **634**. The controls for motor **626** and heater **628** can include a timer and thermostat (not shown), as disclosed by timer **103** and thermostat **108**, as shown in FIG. **8**.

Latches **637** releasably attach housing **604** to the side walls of chest **601**. As seen in FIG. **16**, chest **601** has an upwardly-directed lip **638** that accommodates a bottom portion of housing **104**. A handle **605**, attached to the top of housing **104**, is used to carry the housing.

Chest **106** and housing **104** are mounted on a movable carriage comprising a pair of wheels **614** and **616** rotatably mounted on the lower end of housing **601**. An elongated handle **617**, attached to the bottom wall **607** of chest **601**, serves as a hand grip to facilitate the moving of dryer **600** on the floor surface **618**. Handle **617** can be provided with extendible and retractable structures to extend the length of the handle. Handle **617** can be a rigid, one-piece structure attached to bottom wall **607** and supporting the housing **604**.

Peg board, or walls having holes **631** and **632**, are located adjacent opposite sides of drying chamber **608**. Wall **631** is located inwardly from side wall **602** forming a passage **633** to allow air to flow from drying chamber **608** back to mixing chamber **621** in housing **604**. Peg board **632** is located inwardly from side wall **603** forming a passage **634** to allow air to flow from drying chamber **608** into mixing chamber **621**. The air in mixing chamber **621** is drawn by fan **624** back into drying chamber **608**, thereby recirculating air from drying chamber **608** through mixing chamber **621** back into drying chamber **608**. The recirculation of the air increases the moisture content of the air and improves the drying effectiveness and heat conservation efficiency. Part of the air in drying chamber **608** is recirculated back into mixing chamber **621**. The remaining portion of the air is directed through filter **629** into the atmosphere, as indicated by arrows **633**.

The detachable heat and fan unit in housing **604** is usable in association with a bag or equipment carrier. The equipment can be dried right in the carrier when the heat unit is attached thereto. The cover **609** can be a two-piece cover that opens in the middle to allow the dryer to be in an upright position for loading and unloading purposes.

While there has been shown and described preferred embodiments of the dryer of the invention, it is understood that changes in the structure and arrangement of structure can be made by those skilled in the art without departing from the invention. Changes in the locations, types and number of fans, heaters and ultraviolet and infrared lights and use of dehumidifiers in the dryers can be made by one skilled in the art which are equivalent to the claimed structure. The dryer can be vented to the outdoor environment with suitable ducts in lieu of exhaust filters. The invention is defined in the following claims.

I claim:

**1**. A dryer for articles comprising: housing means having an internal drying chamber for accommodating articles, door means movably mounted on the housing means for movement to an open position to permit access into the drying chamber and to a closed position to enclose the drying chamber, wall means within said housing means providing an air mixing chamber, said wall means having first and second openings to allow air to flow from the air mixing chamber into the drying chamber and out of the drying chamber into the air mixing chamber, heater means for heating air flowing into the drying chamber, first fan means located within the air mixing chamber operable to move air from the mixing chamber through said first opening into the drying chamber, second fan means located within the air mixing chamber operable to draw air from the drying chamber and discharge air mixing chamber, said housing means having at least one first opening communicating the air mixing chamber with the environment outside the dryer, damper means movable between open and closed positions relative to said first opening to selectively open and close said first opening to allow air to flow out of the air mixing chamber to the environment outside of the dryer and block the flow of air through said first opening, first control means responsive to the humidity of the air in the drying chamber for moving the damper means between the open and closed positions thereof, said second fan means operable to discharge air through the first opening to the environment outside of the dryer when the damper means is in the open position, first filter means mounted on the housing means covering said first opening to remove odors from the air flowing through said filter means, said housing means having at least one second opening into the drying chamber to allow outside air to flow into the drying chamber, second filter means extending across said second opening into the drying chamber to remove odors from the air flowing into the drying chamber, and second control means for the heater means and first and second fan means operable to connect the heater means and first and second fan means to a source of power whereby the first fan means moves air from the mixing chamber into the drying chamber, the heater means heats the air in the drying chamber, the heater means so that the air is heated and discharged as hot air into the drying chamber and the second fan means draws air from the drying chamber and air mixing chamber and discharges air to the environment outside of the dryer when the damper means is in the open position, said air in the drying chamber circulating and recirculating within the drying chamber to remove moisture from the articles within the drying chamber.

**2**. The dryer of claim **1** including: infrared light means within said drying chamber, and control means for connecting the infrared light means to a source of electric power whereby the infrared light means emits infrared light which heats the articles and the air within the drying chamber.

**3**. The dryer of claim **1** wherein: said housing means has a back wall with said second opening open to the drying chamber and the environment outside of the dryer to allow air to flow into the drying chamber.

**4**. The dryer of claim **1** including: bench means located within the drying chamber for accommodating at least one person.

**5**. The dryer of claim **4** including: means to pivotally attach the bench means to the housing means for movement between a generally horizontal position and an upright position.

**6**. The dryer of claim **1** including: drum means located within the drying chamber; means supporting the drum means for rotation about a generally horizontal axis, and means for rotating the drum means.

**7**. The dryer of claim **6** wherein: the drum means has a plurality of openings to allow air to flow through the drum means.

**8**. The dryer of claim **6** wherein: the means supporting the drum means comprise a plurality of rollers rotatably mounted on the housing means.

**9**. The dryer of claim **6** wherein: the means for rotating the drum means includes motor means mounted on the housing means, and means driveably connecting the motor means to the drum means.

**10**. The dryer of claim **1** wherein: the first control means

includes a humidistat and means connected to the humidistat for moving the damper means between the open and closed positions thereof, said humidistat being operable when the moisture content of the air in the drying chamber is above a selected level to signal the means for moving the damper means to move the damper means to the open position whereby air in the mixing chamber is discharged to the environment outside of the dryer.

**11**. The dryer of claim **1** including: a boot dryer located within the drying chamber, said boot dryer having a casing accommodating an article, said tube means having a passage open to the internal chamber and the article, ultraviolet light means within the passage of the tube means adapted to emit ultraviolet light into the passage of the tube means and article on the tube means, and means for moving air through said chamber and tube means to dry the article retained on the tube means.

**12**. A dryer for articles comprising: housing means having an internal drying chamber for accommodating articles, means to permit access into the drying chamber to allow articles to be placed within the drying chamber, wall means within said housing providing an air mixing chamber, said wall means having at least one opening to allow air to flow from the air mixing chamber into the drying chamber and out of the drying chamber into the air mixing chamber, heater means for heating air in the drying chamber, first means operable to move air from the mixing chamber and into the drying chamber, second means operable to draw air from the drying chamber and selectively discharge air to the mixing chamber and the environment outside of the dryer, said housing means having a first opening open to the mixing chamber and the environment outside of the dryer and a second opening open to the drying chamber and the environment outside of the dryer, damper means movable between open and closed positions relative to said first opening to selectively open and close said first opening to allow air to flow out of the air mixing chamber to the environment outside the dryer and block the flow of air through said first opening, control means responsive to the moisture content of the air in the drying chamber for moving the damper means between the open and closed positions thereof from the environment outside of the dryer into the drying chamber.

**13**. The dryer of claim **12** including: bench means located within the drying chamber for accommodating at least one person.

**14**. The dryer of claim **13** including: means to pivotally attach the bench means to the housing means for movement between a generally horizontal position and an upright position.

**15**. The dryer of claim **12** including: drum means located within the drying chamber, means supporting the drum means for rotation about a generally horizontal axis, and means for rotating the drum means.

**16**. The dryer of claim **15** wherein: the drum means has a plurality of openings to allow air to flow through the drum means.

**17**. The dryer of claim **15** wherein: the means supporting the drum means comprises a plurality of rollers rotatably mounted on the housing means.

**18**. The dryer of claim **15** wherein: the means for rotating the drum means includes motor means mounted on the housing means, and means driveably connecting the motor means to the drum means.

**19**. The dryer of claim **12** wherein: the first control means includes a humidistat and means connected to the humidistat for moving the damper means between the open and closed positions thereof, said humidistat being operable when the moisture content of the air in the drying chamber is above a selected level to signal the means for moving the damper means to move the damper means to the open position whereby air in the mixing chamber is discharged to the environment outside of the dryer.

**20**. The dryer of claim **12** including: a boot dryer located within the drying chamber, said boot dryer having a casing with an internal chamber, tube means mounted on the casing means for accommodating an article, said tube means having a passage open to the internal chamber and the article, ultraviolet light means within the passage of the tube means adapted to emit ultraviolet light into the passage of the tube means and article of the tube means, and means for moving air through said chamber and tube means to dry the article retained on the tube means.

* * * * *